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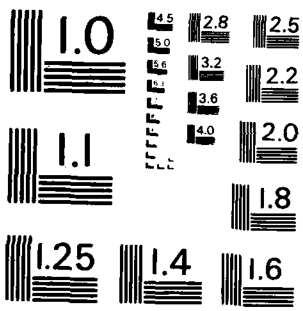

MICROCOPY RESOLUTION TEST CHART
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INSTALLATION RESTORATION PROGRAM

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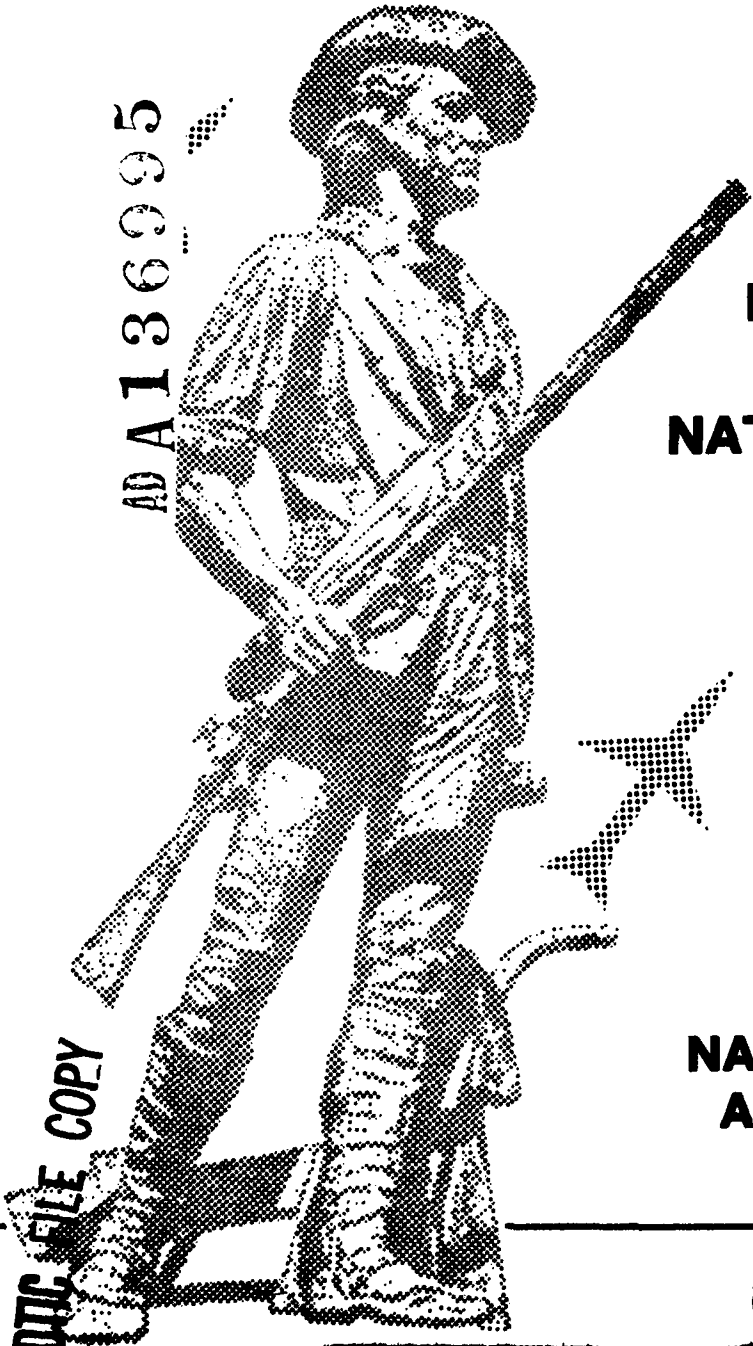

PHASE I
RECORDS SEARCH
BUCKLEY AIR
NATIONAL GUARD BASE,
COLORADO

PREPARED FOR

BUCKLEY AIR
NATIONAL GUARD BASE
AURORA, COLORADO

SEPTEMBER, 1982

sla
SIMONS, LI & ASSOCIATES, INC.

INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH
BUCKLEY AIR NATIONAL GUARD BASE
AURORA, COLORADO

Prepared for

Buckley Air National Guard Base
Aurora, Colorado

By

Simons, Li & Associates, Inc.
P.O. Box 1816
Fort Collins, Colorado 80522

August 31, 1982

This report has been prepared for the Air National Guard by Simons, Li & Associates, Inc. for the purpose of aiding in the implementation of the Air National Guard Installation Restoration Program. It is not an endorsement of any product. The views expressed herein are those of the contractor and do not necessarily reflect the official views of the publishing agency, the Air National Guard, or the Department of Defense.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Problem Confirmation; Phase III, Technology Base Development; and Phase IV, Operations. Simons, Li & Associates, Inc. (SLA) was retained by the Air National Guard to conduct the Phase I, Initial Assessment/Records Search at Buckley Air National Guard Base under Contract No. DAHA05 82 C 0006.

INSTALLATION DESCRIPTION

Buckley ANGB is located in Aurora, Colorado. Buckley was activated in 1942 and has operated under Army, Navy, and Air National Guard command. The primary mission of the base is to train Air National Guard personnel.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this study indicate the following key items concerning the impact of past waste disposal practices on the base:

- Surficial soils at Buckley ANGB are predominantly clay and silt loams. These soils have low to moderate permeabilities and are relatively erodible.
- The Denver Aquifer lies at or near the ground surface. The ground water is used for domestic and irrigation purposes. The upper section of the aquifer is unsaturated.
- No rare or endangered species of plants or wildlife are found at Buckley ANGB.
- Precipitation is about 14 inches per year and annual evaporation and transpiration is between 40 and 50 inches.

METHODOLOGY

During the course of this project, interviews were conducted with those past and present base personnel familiar with past waste disposal practices. File searches were performed for facilities which have generated, handled,

transported, and disposed of waste materials. Interviews were held with local, state, and federal agencies, and site inspections were conducted at facilities that have generated, treated, stored, and disposed of hazardous waste. Eight disposal sites located on Buckley ANGB property were identified as containing hazardous waste resulting from past waste disposal activities (Figure 1). These sites have been assessed using a hazard assessment rating methodology (HARM), which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration, and waste management practices. The details of the rating procedure are presented in Appendix I and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on action.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team's field inspection, review of base records and files, and interviews with base personnel.

Six sites were determined to have a moderate potential for migration of contaminants. These are as follows:

- Fire Training Area No. 2 ;
- Oil Pit ;
- Base Dump ;
- Fire Training Area No. 3 ;
- Fire Training Area No. 1 ; and
- Storm Drainage System at Building 801.

Two sites were determined to have a low potential for contaminant migration. These are as follows:

- Sludge drying bed ; and
- Army aircraft burial site.

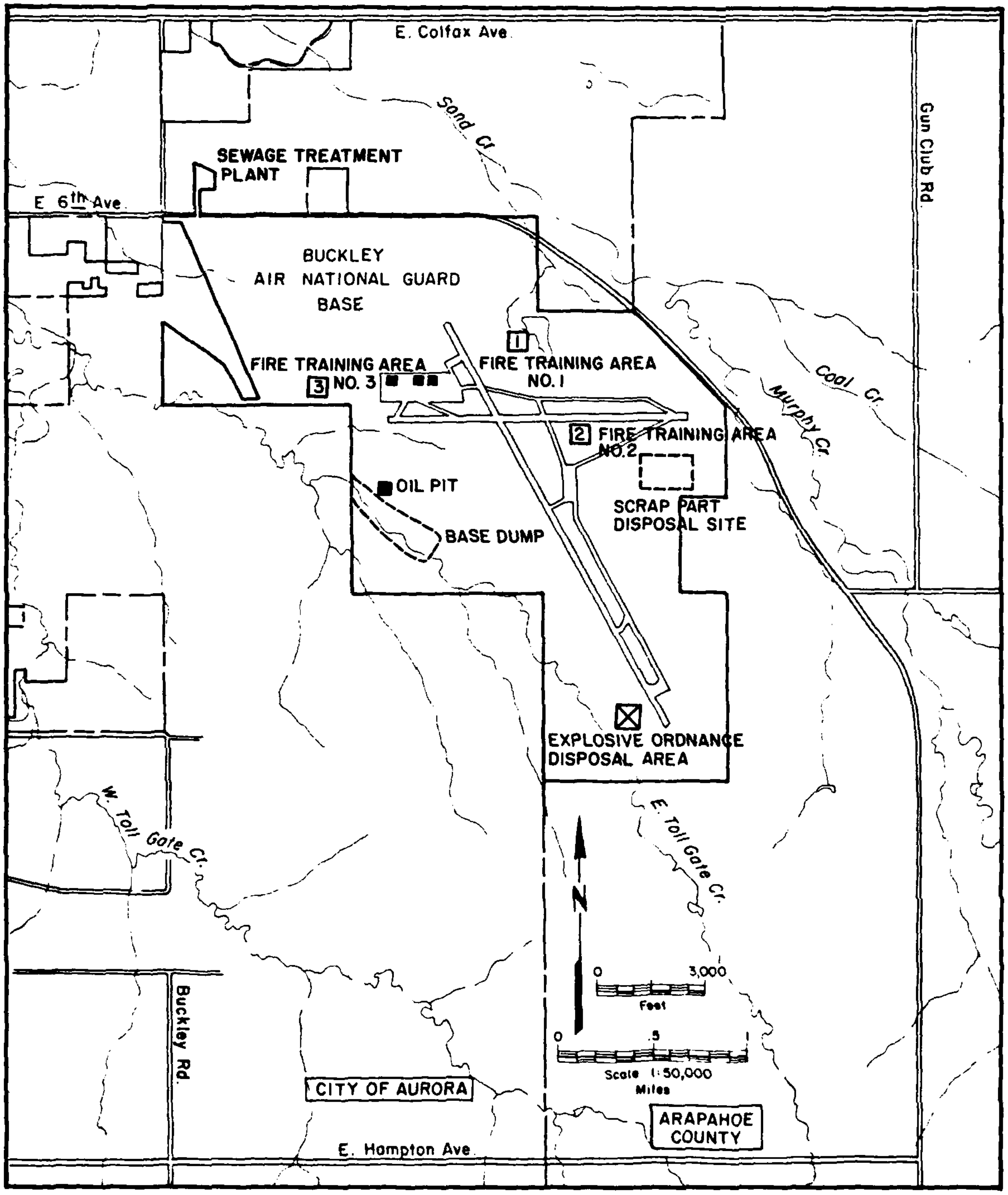


FIGURE 1. POTENTIAL SITES FOR CONTAMINANT MIGRATION

Table 1. Priority Ranking of Potential Contamination Sources at Buckley ANGB.

Rank	Site Name	Date of Operation	Total Overall Score
1	Fire Training Area No. 2	1950 - 1972	63
2	Oil Pit	1950 - 1082	62
3	Base Dump	1942 - 1982	61
4	Fire Training Area No. 3	1972 - 1982	61
5	Fire Training Area No. 1	1946 - 1950	55
6	Storm Drainage System	1942 - 1982	52
7	Sludge Drying Beds	1942 - 1978	46
8	Army Aircraft Burial Site	1942 - 1945	40

RECOMMENDATIONS

The detailed recommendations developed for further assessment of potential contaminant migration are presented in Chapter VI. These recommendations are summarized as follows:

- Fire Training Area No. 2: Obtain soil borings in and around the area. Analyze samples to determine level of contamination.
- Oil Pit: Analyze contents and obtain soil borings.
- Base Dump: Obtain soil borings and collect sediment and runoff samples from East Toll Gate Creek.
- Fire Training Area No. 3: Obtain soil borings in and around the area.
- Fire Training Area No. 1: Obtain soil borings in and around the area.
- Storm Drainage System at Building 801: Collect and analyze sediment and runoff samples from drainage system.

CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

BACKGROUND

The Air National Guard has in the past been engaged in a variety of operations dealing with hazardous materials. Federal, state and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate hazards in an environmentally responsible manner. The Department of Defense (DOD) has issued a Defense Environmental Quality Program Policy Memorandum which requires the identification and evaluation of past hazardous material disposal sites on DOD property, the control of migration of hazardous contaminants, and the control of hazards to health or welfare that resulted from these past operations. This program is called the Installation Restoration Program (IRP). The IRP will be a basis for response actions on Air Force Installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I - Initial Assessment/Records Search

Phase II - Problem Confirmation

Phase III - Technology Base Development

Phase IV - Operations

Simons, Li & Associates, Inc. (SLA) was retained by the Air National Guard to conduct the Phase I Records Search at Buckley Air National Guard Base (ANGB) under Contract No. DAHA05 82 C 0006. This report contains a summary and an evaluation of the information collected during Phase I of the IRP.

The goal of the first phase of the program was to identify the potential for environmental contamination from past waste disposal practices at Buckley ANGB, and to assess the potential for contaminant migration. The activities undertaken in Phase I included the following:

- Review site records

- Interview personnel familiar with past generation and disposal activities

- Inventory hazardous materials

- Determine quantities and locations of current and past hazardous waste storage, treatment, and disposal

- Define the environmental setting at the base

- Review past disposal practices and methods

- Conduct field inspection

- Gather pertinent information from federal, state, and local agencies

- Assess potential for contaminant migration

In order to perform the on-site portion of the records search phase, SLA assembled the following core team of professionals:

Ruh-Ming Li, Ph.D., Project Reviewer

Kenneth G. Eggert, Ph.D., Project Manager

Thomas P. Ballestero, Ph.D., Senior Hydrologist

Thomas C. Fairley, Project Engineer

Walter W. Melvin, Jr., M.D., Ph.D., Toxicologist

METHODOLOGY

The methodology utilized in the Buckley ANGB records search began with a review of past and present operations conducted at the base. Information was obtained from available records and interviews with past and present base employees from various operating areas of the base. Those interviewed included personnel associated with wastewater treatment, pesticide operations, fuel storage and dispensing, aircraft maintenance, and other base activities. Personnel from tenant organizations were also interviewed.

Federal, state, and local agencies were also contacted and interviewed for pertinent base-related environmental data. The agencies contacted are listed in Appendix B.

The next step in the activity review was to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various operations on the base. This portion of the review included the identification of all known past disposal sites and any other possible sources of contamination, such as fuel-saturated areas around the fire training areas. A helicopter overflight and ground tour of the identified sites were then made by the SLA project team to gather site-specific information.

A decision was then made, based upon all of the above information and utilizing the decision tree shown in Figure 4.1, concerning the existence of potential for hazardous material contamination at any of the identified sites. For those sites where a potential for contamination was identified, a determination of the potential for migration of the contamination was made by considering site-specific conditions. If no potential exists, the site was deleted from further consideration.

If the potential for contaminant migration was considered significant, the site was evaluated and prioritized using the hazardous assessment rating methodology (HARM). The HARM score indicates the relative potential for contaminant migration at each site. For those sites showing a high potential, recommendations are made to quantify the potential contaminant migration problem under Phase II of the Installation Restoration Program. For those sites showing a moderate potential, a limited Phase II program may be recommended to confirm that a contaminant migration problem does or does not exist. For those sites showing a low potential, no further follow up Phase II work is recommended.

CHAPTER II

INSTALLATION DESCRIPTION

CHAPTER II

INSTALLATION DESCRIPTION

LOCATION, SIZE, AND BOUNDARIES

Buckley ANGB is located in Aurora, Colorado (Figures 2.1, 2.2, and 2.3). The base covers 3,540 acres in the Sand Creek and East Toll Gate Creek drainage basins. Present land usage adjacent to the base is as follows:

North - Industrial and agricultural

West - Commercial and residential

South - Residential and agricultural

East - Agricultural

BASE HISTORY

The land areas now known as Buckley Air National Guard Base are the remainder of a parcel of 5,740 acres which the Federal Government purchased in 1942-43 primarily to train bombardiers and armorers for the U.S. Army Air Corps. Original cost of construction was about 15 million dollars. In Buckley's peak year of operation, 35,000 students graduated from various training courses. As World War II ended, the activities and population at Buckley decreased to about 7,500 personnel in 1946.

Buckley Field was placed in inactive status in July of 1946 and transferred to the State of Colorado. Units of the Colorado Air National Guard occupied the field in an inactive training status. In 1947, the U.S. Navy assumed jurisdiction over the field, with a portion still permitted to, and under control of the Colorado Air National Guard. Buckley was then known as Naval Air Station-Denver, Colorado. This arrangement continued until May 1959, when the U.S. Navy deactivated the station. Concurrently, it was licensed to the State of Colorado and was designated Buckley Air National Guard Base. Buckley has been under Colorado Air National Guard command and control since that time.

The airfield complex consists of two runways of 11,000 feet and 8,000 feet. All structures are categorized as either operations, maintenance or

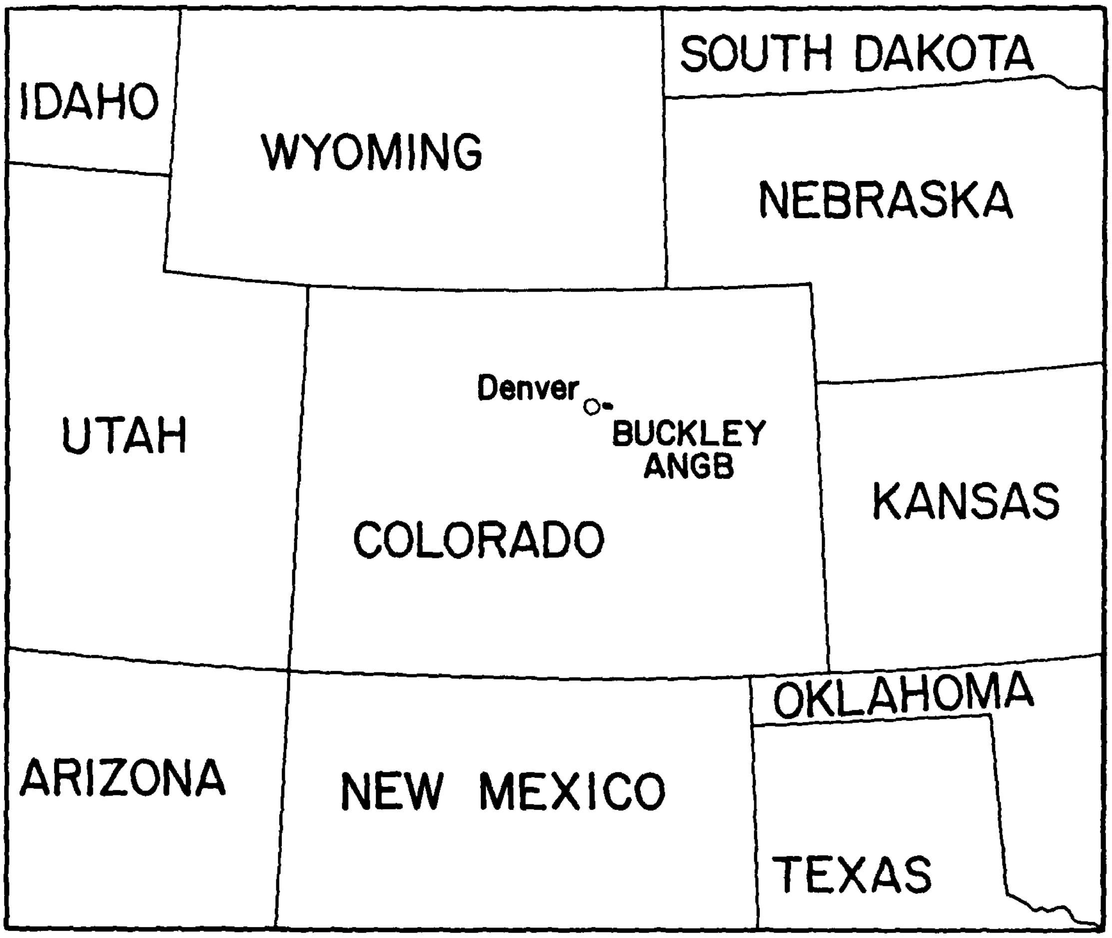


FIGURE 2.1. REGIONAL LOCATION MAP

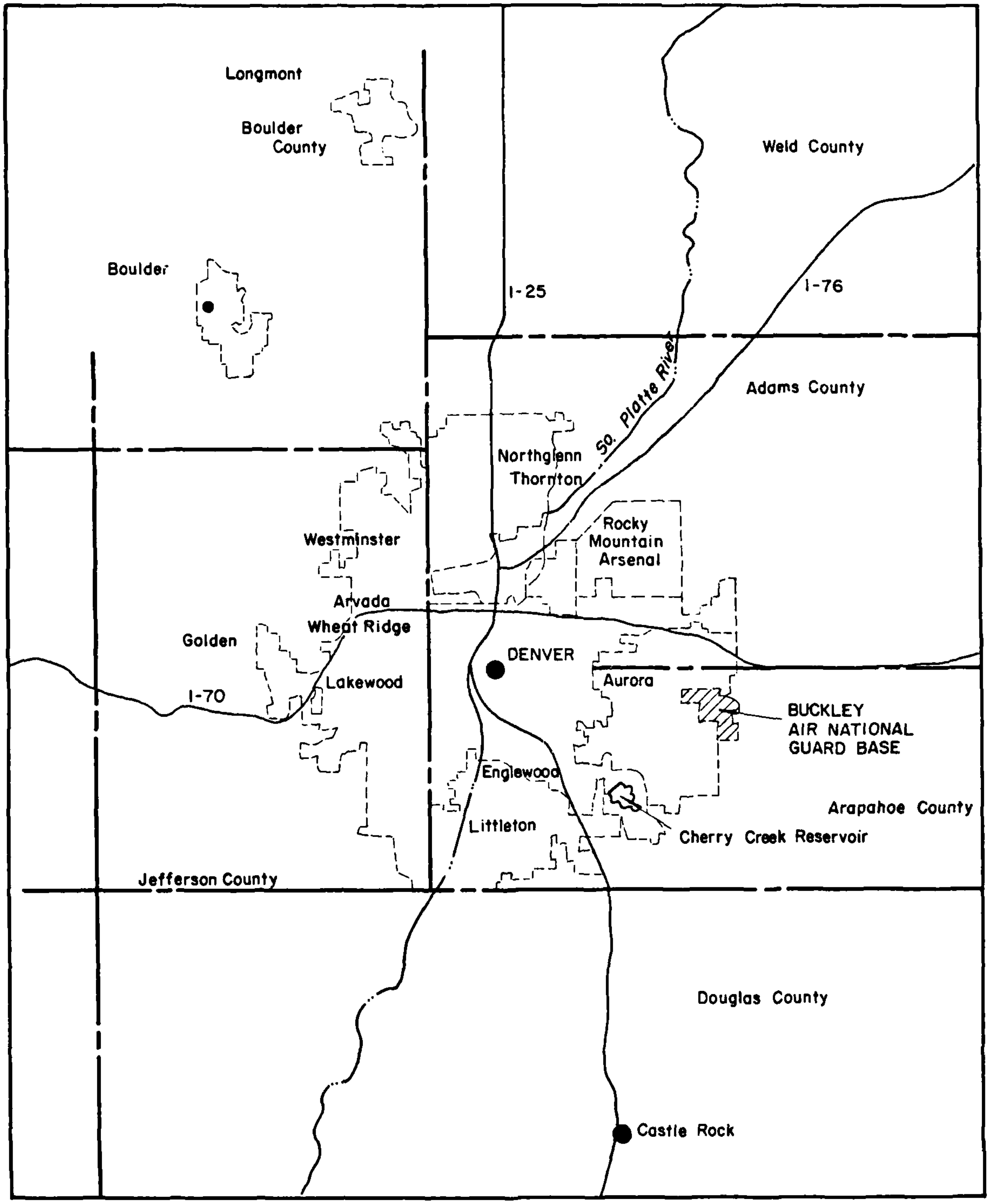


FIGURE 2.2 AREA LOCATION MAP

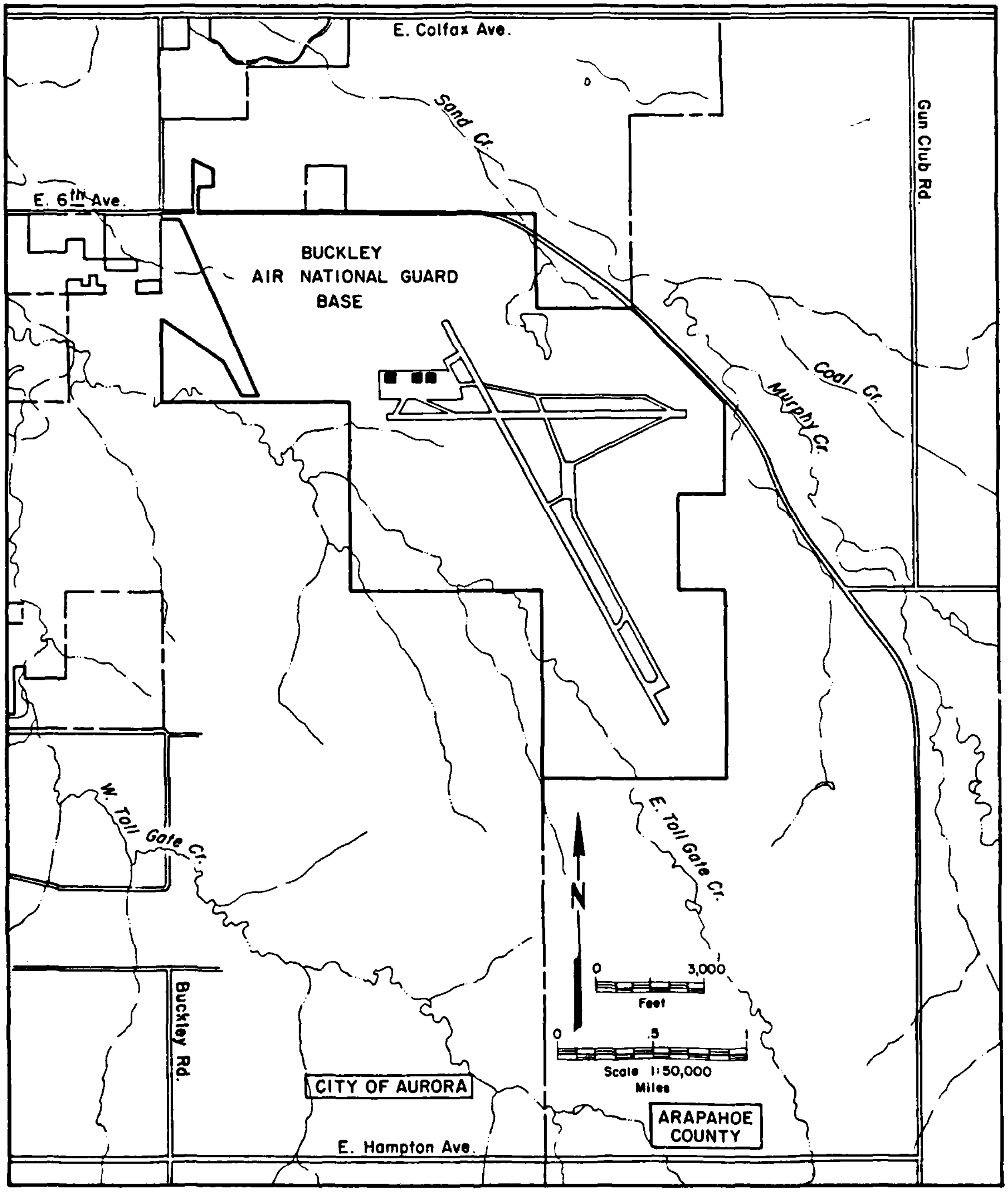


FIGURE 2.3. SITE MAP

training facilities. The base has few community facilities. All facilities are fully occupied and in use.

Further details of the history of Buckley ANGB are included in Appendix C.

MISSION

Buckley ANGB has three distinct missions. The base provides the site for training to combat readiness of tactical units of the Colorado Air National Guard; it is the only military air base in the Denver metropolitan area and supports aircraft of all commands and services around the clock; and it provides support for numerous Department of Defense tenant activities assigned to the base. As the only military flying base in the area, Buckley is also charged with certain responsibilities related to aircraft search and crash response within the geographical area. In addition to supporting over 60 base assigned aircraft, the base also supports up to 10,000 transient military aircraft per year.

ORGANIZATION

Assigned Units/Activities at Buckley ANGB include the following:

COLORADO AIR NATIONAL GUARD:

- Detachment 1, Headquarters, Colorado ANG (Host)
- 140th Tactical Fighter Wing and Assigned Units
- 154th Tactical Control Group

TENANTS:

- Det 3, SAMSO (Aerospace Data Facility) (AFSC)
- 2nd Comm Sq (Aerospace Data Facility) (SAC)
- Det 3, 375th Aeromedical Airlift Wing (MAC)
- Det 29, 15th Weather Squadron (MAC)
- 1987th Communications Squadron (FF) (AFCS)
- Marine Air Reserve Training Unit
- Naval Air Reserve Training Detachment
- Colorado Army National Guard
  - 19th Special Forces Group (AB)
  - 147th Medical Hospital
  - 1157th Aviation Company (Attack Helicopter)
  - Army Aviation Support Facility

ANG/CCTV - Multi-Media Production Center

Lowry AFB Aero Club

Civil Air Patrol

CHAPTER III

ENVIRONMENTAL SETTING

CHAPTER III

ENVIRONMENTAL SETTING

The environmental setting of Buckley ANGB is described in this chapter with the primary emphasis directed toward identifying features that affect the movement of hazardous waste contaminants.

METEOROLOGY

The climate of the Buckley ANGB area is characteristic of Colorado high plains areas. Typically, this area experiences cold, dry winters and relatively cool, dry summers. Low humidity and low precipitation rates, extreme fluctuations in daily and seasonal temperatures and occasional high winds are normal for this semi-arid, continental-type climate. Air masses from at least four sources influence Buckley's weather; Artic air from Canada and Alaska, warm, moist air from the Gulf of Mexico, warm, dry air from the Southwest, and Pacific air modified by its passage over the Coastal, Sierra Nevada and Rocky Mountain Ranges to the west.

Temperatures reach 90°F 33 times per year on an average, but reach 100°F only once in five years. Average monthly temperatures range from 29.9°F in January to 73°F in July (see Table 3.1). The all-time record high temperature is 105°F and the record low is -30°F.

Precipitation averages 14.5 inches per year including an average of 59.6 inches of snow per year. Spring is the wettest, cloudiest, and windiest season. Precipitation accounting for 37 percent of the yearly total falls as snow or rain in the spring months. Summer precipitation is generally in the form of scattered local thunderstorms and accounts for 32 percent of the yearly total. Autumn has a greater percentage of sunny weather than any other season and winter has the least precipitation (11 percent) of the yearly total. Periods of severe winter weather are generally brief. The highest recorded yearly precipitation is 23.31 inches and the low is 7.51 inches. The highest recorded sustained wind speed is 65 mph with gusts occasionally exceeding 100 mph. The average pan evaporation rate is about 50 inches per year. The average evapotranspiration rate is estimated to be between 40 and 50 inches per year, depending on the type of vegetative cover. A summary of meteorological data is given in Table 3.1.

Table 3.1. Meteorological Data for the Buckley Air National Guard Base Area, 1934 to 1980.

Temperature (°F)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°F)												
Extreme Maximum	72	76	84	85	96	104	104	105	97	88	79	75
Extreme Minimum	-25	-30	-11	- 2	22	30	43	41	20	3	- 8	-18
Mean Maximum	43.5	46.2	50.1	61.0	70.3	80.1	87.4	85.8	77.7	66.8	53.3	46.2
Mean Minimum	16.2	19.4	23.8	33.9	43.6	51.9	58.6	57.4	47.8	37.2	25.4	18.9
Mean Monthly	29.9	32.8	37.0	47.5	57.0	66.0	73.0	71.6	62.8	52.0	39.4	32.6
Surface Wind (mph)												
Prevailing Direction	S	S	S	S	S	S	S	S	S	S	S	S
Average Speed	9.0	9.2	9.9	10.3	9.5	9.1	8.5	8.2	8.2	8.1	8.6	8.9
Maximum Speed	53	49	53	56	65	47	56	42	47	45	48	51
Precipitation (Inches)												
Maximum	1.44	1.66	2.89	4.17	7.31	4.69	6.41	5.85	4.67	4.17	2.97	2.84
Minimum	0.01	0.01	0.13	0.03	0.06	0.09	0.17	0.06	T	0.05	0.01	0.03
Average	0.61	0.67	1.21	1.93	2.64	1.93	1.78	1.29	1.13	1.13	0.76	0.43
Snowfall Average	8.1	7.7	12.7	9.4	1.9	T	0.0	0.0	1.6	3.7	8.0	6.5
Snowfall Maximum	23.7	18.3	29.2	28.3	13.6	0.3	0.0	0.0	21.3	31.2	39.1	30.8
Average Number of Thunderstorms	0	*	*	1	6	10	11	8	3	1	*	0

T = Trace
* = Less than one half

Source: National Oceanic and Atmospheric Administration, National Climatic Center, "Local Climatological Data - Denver, Colorado," 1980.

GEOGRAPHY

Buckley ANGB lies within the Colorado high plains area. The area is characterized by rolling hills and relatively steep drainageways.

Topography

Buckley ANGB is situated on high ground dividing the Sand Creek and Toll Gate Creek drainage basins. The ground surface elevation of the base ranges from 5,700 feet mean sea level (MSL) at the southeast corner to 5,480 feet MSL at the northwest corner. The overall ground slope is one percent to the northwest.

Drainage

Drainage of Buckley ANGB is accomplished by overland flow to drainage channels which lead either to Sand Creek or Toll Gate Creek (Figure 3.1). East Toll Gate Creek is an intermittent stream which crosses the southwest corner of the base. Sand Creek sustains a small base flow throughout most of the year. East Toll Gate Creek is a tributary of Sand Creek, and Sand Creek is a tributary of the South Platte River. Both Sand Creek and East Toll Gate Creek have sand-bed channels. In sand-bed streams, the bed material is easily eroded and is continually moved and reshaped by the flow, and therefore, during large flows, lateral migration, bank sloughing, and degradation can occur.

Soils

Three major soil associations have been identified at Buckley ANGB. These are (1) Alluvial land-Nunn association; (2) Renohill-Buick-Litle association; and (3) Fondis-Weld association. Alluvial land-Nunn soils are found along Sand Creek and consist of deep, loamy, and sandy soils. The Renohill-Buick-Litle (RBL) association is found on the East Toll Gate Creek uplands. The RBL association is moderately deep and has a loamy to clayey texture. The Fondis-Weld association is formed mainly in silty, wind-deposited materials and is found in the level areas at Buckley ANGB. The Fondis-Weld association typically contains a clayey layer in the subsoil. Rock outcrops are found at Buckley ANGB, predominantly near the runways. A total of 15 soil series have been identified at Buckley ANGB by the USDA Soil

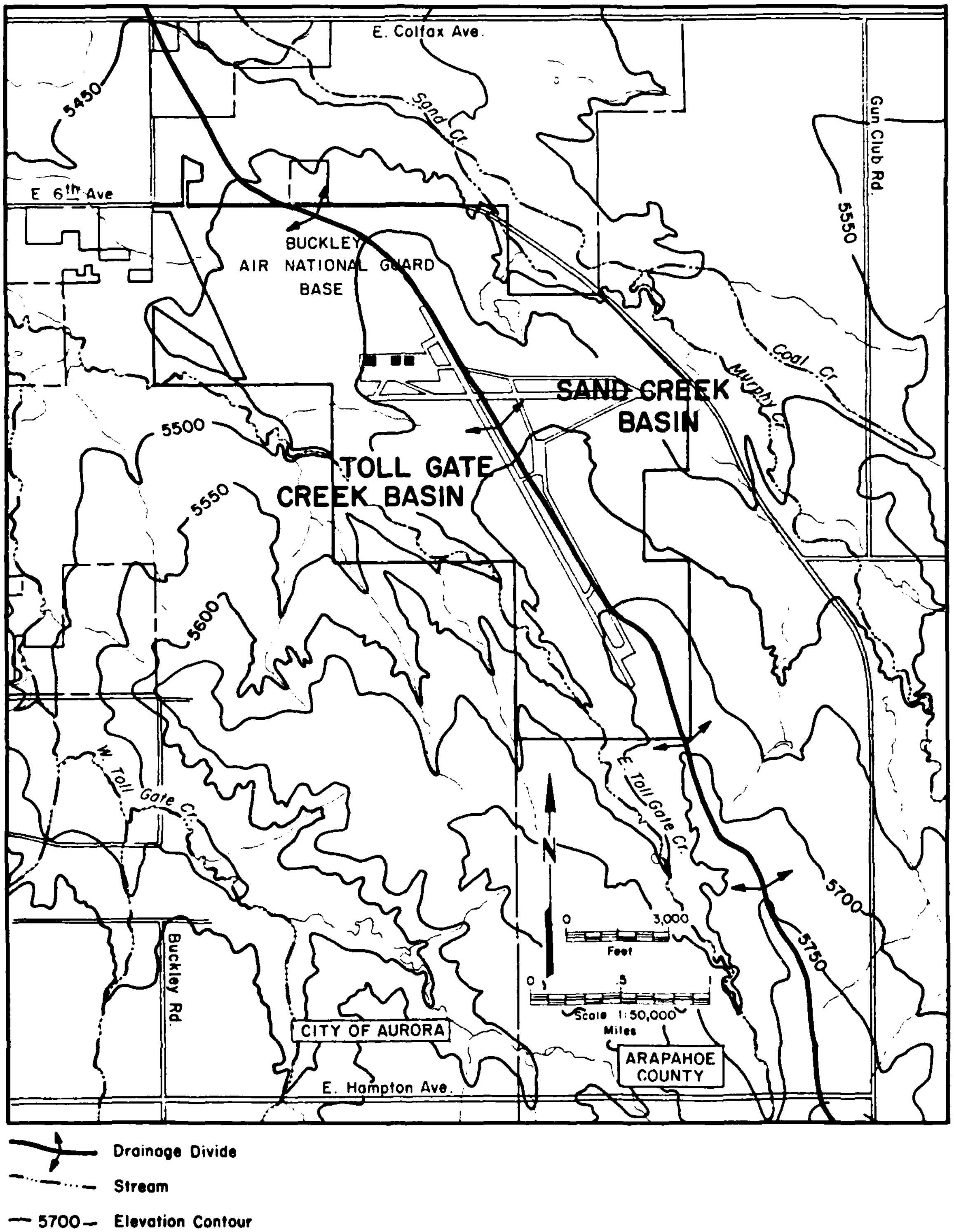


FIGURE 3.1. TOPOGRAPHIC AND DRAINAGE MAP

Conservation Service. Most of the soil series have been classified as moderately to highly erodible.

GEOLOGY

Buckley ANGB lies within the Denver geological basin. The location of the Denver basin is shown in Figure 3.2. Generalized cross sections of the basin are shown in Figure 3.3 and summarized in Table 3.2. The surficial geology of the Buckley ANGB area is shown in Figure 3.4 and described in Table 3.3.

Geologic data specific to Buckley ANGB were obtained from logs of water wells near the base. Typical cross sections are shown in Figure 3.5.

GROUNDWATER

Buckley ANG Base lies within the Denver groundwater basin. The principal aquifers underlying the area are, in descending order, the Denver Formation of Late Cretaceous and Early Tertiary Age and the Arapahoe, Laramie and Fox Hills Formations of Late Cretaceous Age. The Pierre Shale of Late Cretaceous Age, because of its great thickness (5,000 to 7,000 feet) is considered to be the base of the major bedrock system.

The Denver Formation consists of a 600- to 1,000-foot thick series of interbedded shale, claystone, siltstone, and sandstone in which coal and fossilized plant remains are common. The water-bearing layers of sandstone and siltstone occur in poorly-defined irregular beds that are dispersed within relatively thick sequences of claystone and shale. Individual sandstone and siltstone layers are commonly lens-shaped and range in thickness from a few inches to as much as 50 feet. Water-bearing layers penetrated by a well may be of different thicknesses or be absent in an adjacent well because of this lens-shaped layering. Figure 3.6 contains a typical well log for the Buckley area. The sandstone and siltstone generally are only moderately consolidated and are coarser than the claystone and shale, allowing groundwater to flow through the void spaces between the grains of sand and silt, while little water is able to flow through the claystone and shale. The total thickness of the water-bearing layers is about 175 feet in the Buckley area. The Denver Aquifer thus consists of a complex pattern of interconnected beds of permeable and relatively impermeable sediments that differ in their ability to store and transmit water from one area to another.

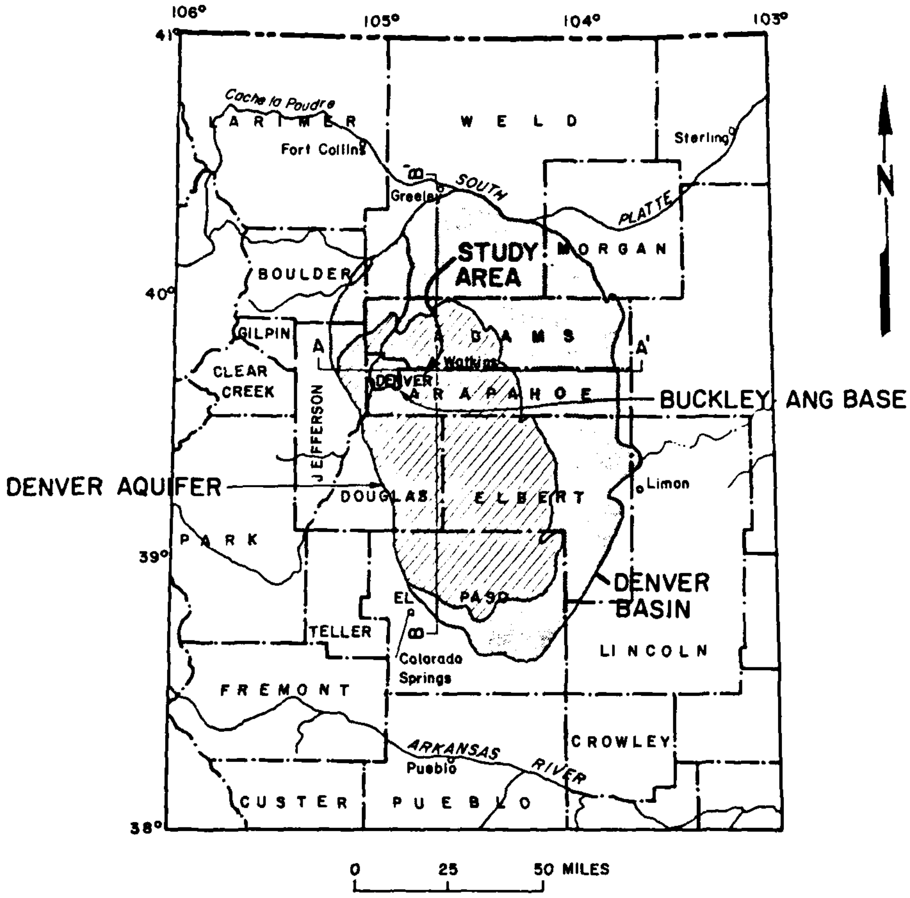


FIGURE 3.2. INDEX MAP SHOWING LOCATION OF DENVER BASIN, AQUIFER, AND GENERALIZED GEOLOGIC SECTIONS

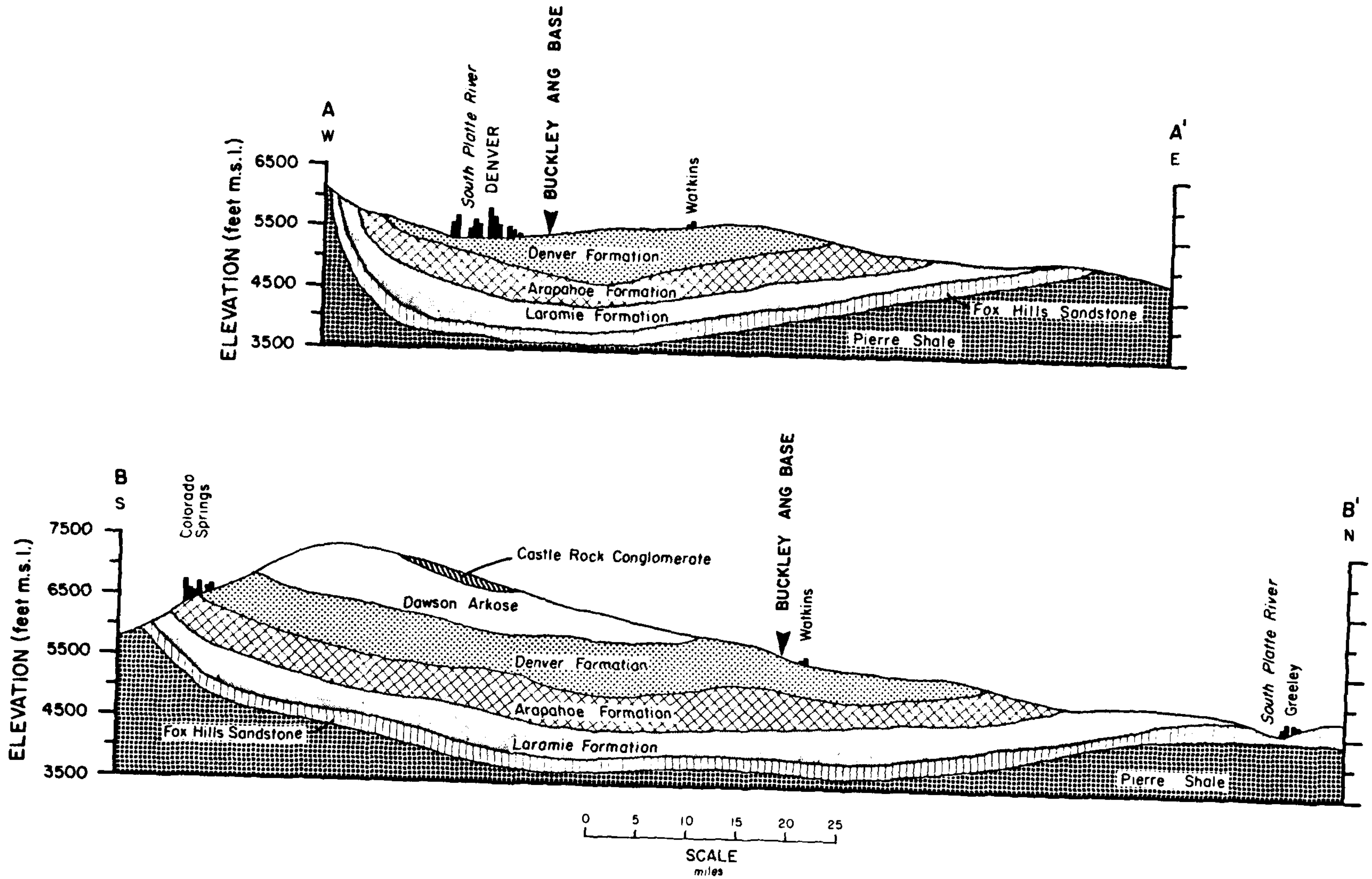


FIGURE 3.3. GENERALIZED GEOLOGIC SECTIONS THROUGH THE DENVER BASIN

Table 3.2. Generalized Section of the Geologic Units.

Era	System or Period	Series	Geologic Unit	Representative Thickness (feet)	Physical Character	Water Supply
Cenozoic and Mesozoic	Tertiary and Cretaceous	*Paleocene*	*Denver Formation*	300-1,100	Gray, brown, dusky yellow, and greenish-gray shale, clay, silt, shale, and siltstone; contains many lenticular beds of light-colored conglomerate, sand, gravel and sandstone in most of the Denver basin. In many places a conglomerate zone lies from 200 to 400 feet above the base of this part; this zone is called the upper conglomerate in this report. The upper conglomeratic zone contains much andesitic material west of Denver but contains predominantly arkose or quartzose sediments elsewhere in the basin. Lenticular beds of coarse arkosic gravel also lie from 200 to 400 feet above the upper conglomerate, especially south of T.5 S. Beds of coarse materials in a similar stratigraphic position on Green Mountain are largely drained. Andesitic material is common in the vicinity of Green Mountain and the Table Mountains, southwest of Denver, and in isolated lenses elsewhere in the basin. Beds of very sandy limestone, lignite, coal carbonaceous clay, carbonaceous silt, and carbonaceous shale are common. Toward the top of this unit south of Denver are beds of rhyolitic ruff and lava. In the Green Mountain-Table Mountains area, it contains beds of more basic lava and tuff.	Yields very small to moderate quantities of water. Locally water is moderately high in iron and radioactive constituents. Upland beds drained in places. Locally moderately high concentrations of dissolved solids and objectionable odors from carbonaceous beds. Poorest quality of water from the andesitic and lignitic beds. The permeability of the upper conglomerate is greatest south of T.5 S. but also is considerable locally east of R. 67W. The upper conglomerate generally yields the greatest quantities obtained from this part of the formation, but the lenticular gravel beds from 200 to 400 feet above the upper conglomerate zone locally yield moderate amounts of water.

Table 3.2 continued.

Era	System or Period	Series	Geologic Unit	Represen-tative Thickness (feet)	Physical Character	Water Supply
		Upper Cretaceous	Arapahoe Formation	400-1,400	White to yellow arkosic sand, gravel, and conglomerate interbedded with gray and green and red shale and clay. Sand, gravel, and conglomerate beds are thicker, more numerous, and more persistent than the upper part. The thickest and most extensive zones of coarse sediments are in the upper 700 feet of this part of the formation. The beds of coarse sediments become progressively thicker and more numerous toward the southwest part of the basin. In the Denver area two persistent zones of coarse materials are recognized; in this report these are referred to as the middle conglomerate and the lower conglomerate. Each of these conglomerate zones ranges in average thickness from 50 to 200 feet. The two conglomerate zones are separated by 50 to 200 feet of shale, siltstone, and silty sandstone.	Yields moderate quantities of water except near outcrops or where affected by local faulting or folding. Water is generally of good quality, is fairly soft, and has fairly low concentrations of dissolved solids.
				400-600	Blue-gray silty shale; contains thick silty sandstone, limestone, and lignite beds. Sandstone beds generally lenticular except near bottom of the unit. Coal beds scattered throughout the formation, but the thickest and most persistent coal beds are in the lower half.	Yields very small quantities of water of poor quality. Contains much hydrogen sulfide, iron, and methane.

Table 3.2 continued.

Era	System or Period	Series	Geologic Unit	Representative Thickness (feet)	Physical Character	Water Supply
			Laramie Formation B sandstone	60-80	Salt and pepper sandstone, mostly medium grained, massive, very extensive. Well cemented along the west side of the basin, weakly cemented to merely compacted elsewhere. Coalesces with A sandstone and Milliken Sandstone Member locally, especially in the Louisville-Niwot area.	Yields moderate quantities of water, usually of good quality except in areas of local geologic structure, where it may have troublesome amounts of methane, hydrogen sulfide, iron, or fluoride.
			A sandstone	30-100	Sandstone beds similar to those of the B sandstone but generally finer grained. Yellowish on weathered surfaces. In most places consists of thin sandstone beds interbedded with siltstone and shale but locally massive. Locally contains a little coal, especially on the west side of basin.	Yields very small to moderate quantities of water, depending upon whether the unit consists chiefly of shale and silt or of sandstone. May have troublesome amounts of methane, hydrogen sulfide, iron or fluoride, especially in areas of local geologic structure.
Mesozoic	Cretaceous	Upper Cretaceous	Fox Hills Sandstone — Milliken Sandstone Member	60-120	Fine-grained quartzose, locally silty sandstone, siltstone, and shale; contains biotite and muscovite and has large calcareous sandstone concretions. Weathered exposures characteristically yellow to yellowish green. Locally contains a little coal. Generally soft, friable. Lower part locally interbedded with silt and shale.	Yields very small to moderate quantities of water, depending upon whether the unit consists chiefly of sandstone or of shale, silt, and silty sandstone. Iron and fluoride locally troublesome.
			Transition Zone	900-1,100	Interbedded very silty fine-grained sandstone and soft fine-grained sandstone and shale, becoming more shaly toward the bottom of the interval.	Not developed as a separate aquifer. Yields very small quantities of water of poor to unpotable quality.

Table 3.2 continued.

Era	System or Period	Series	Geologic Unit	Representative Thickness (feet)	Physical Character	Water Supply
			Pierre Shale	5,000-7,500	Gray, blue, and black shale, sandy shale, and locally silty sandstone, with thin limestone lenses and bentonitic seams.	Generally yields no water except for very small quantities of highly mineralized water near outcrops. In some places potable water obtained from fractured or weathered zones or from sandstone lenses near their outcrops.
			Niobrara Formation	300	Black to gray calcareous shale, gray to greenish-white limestone and white chalky marl.	Fractured limestone locally will yield very small quantities of rather highly mineralized water.
			Benton Shale	500	Black brittle shale, persistent bentonite seams, chalky limestone, and thin sandstone near top.	Fractured shale near outcrop yields very small to small quantities of highly mineralized water.
	Cretaceous	Lower Cretaceous	Dakota Group: South Platte Formation	100	Gray-white fine- to medium-grained friable to firm sandstone; thin bedded to massive, ripple marked; forms hogbacks.	Yields small to moderate quantities of water near outcrop areas. Water locally contains excessive iron.
				150	Dark-gray silty carbonaceous shale, locally fossiliferous; contains fire clay.	Yields no water.
			Dakota Group: Lytle Formation	60	Gray coarse-grained sandstone; locally conglomeratic and crossbedded.	Yields small to moderate quantities of water in and near outcrop.
Mesozoic			Morrison Formation	300	Varicolored silty sandstone, marlstone, limestone, red silty mudstone, and local gypsum beds. Purple, red, gray, greenish gray, green, and yellow colors common.	Not developed as an aquifer. Basal sandstone bed might yield small quantities of water close to outcrops.

Table 3.2 continued.

Era	System or Period	Series	Geologic Unit	Representative Thickness (feet)	Physical Character	Water Supply
	Jurassic	Upper Jurassic	Ralston Creek Formation	120	Principally varicolored claystone, limestone, and calcareous siltstone, commonly gray, grayish red, or grayish orange. At the base is a 5-foot bed of fine-to medium-grained calcareous sandstone.	Not developed as an aquifer. Basal sandstone bed might yield small quantities of water close to outcrops.
	Triassic and Permian		Lykins Formation	400	Interbedded soft sandstone and sandy shale with thin limestone beds.	Not developed as an aquifer.
	Permian		Lyons Sandstone	200	Friable crossbedded quartzose sandstone	Yields small to moderate quantities of water near outcrop.
Paleozoic	Carboniferous Pennsylvanian		Fountain Formation	1,100	Crossbedded very arkosic conglomeratic sandstone, interbedded with mudstone and siltstone. Forms Red Rock Park and amphitheater and Roxborough Park	Yields small quantities of water near outcrop. Water may contain excessive iron and fluoride; may be excesssively mineralized in faulted areas and may be contaminated with dead oil, especially near the base.
	Precambrian		Crystalline		Granite, gneiss, schist, quartzite, pegmatites, quartz veins, and intrusive igneous rocks.	Yields very small to small quantities of water from fractured and weathered zones. Water generally of fair to good quality; locally, however, may contain excessive amounts of iron and be somewhat hard.

Source: Colorado Water Conservation Board, "Basic Data Report No. 15"

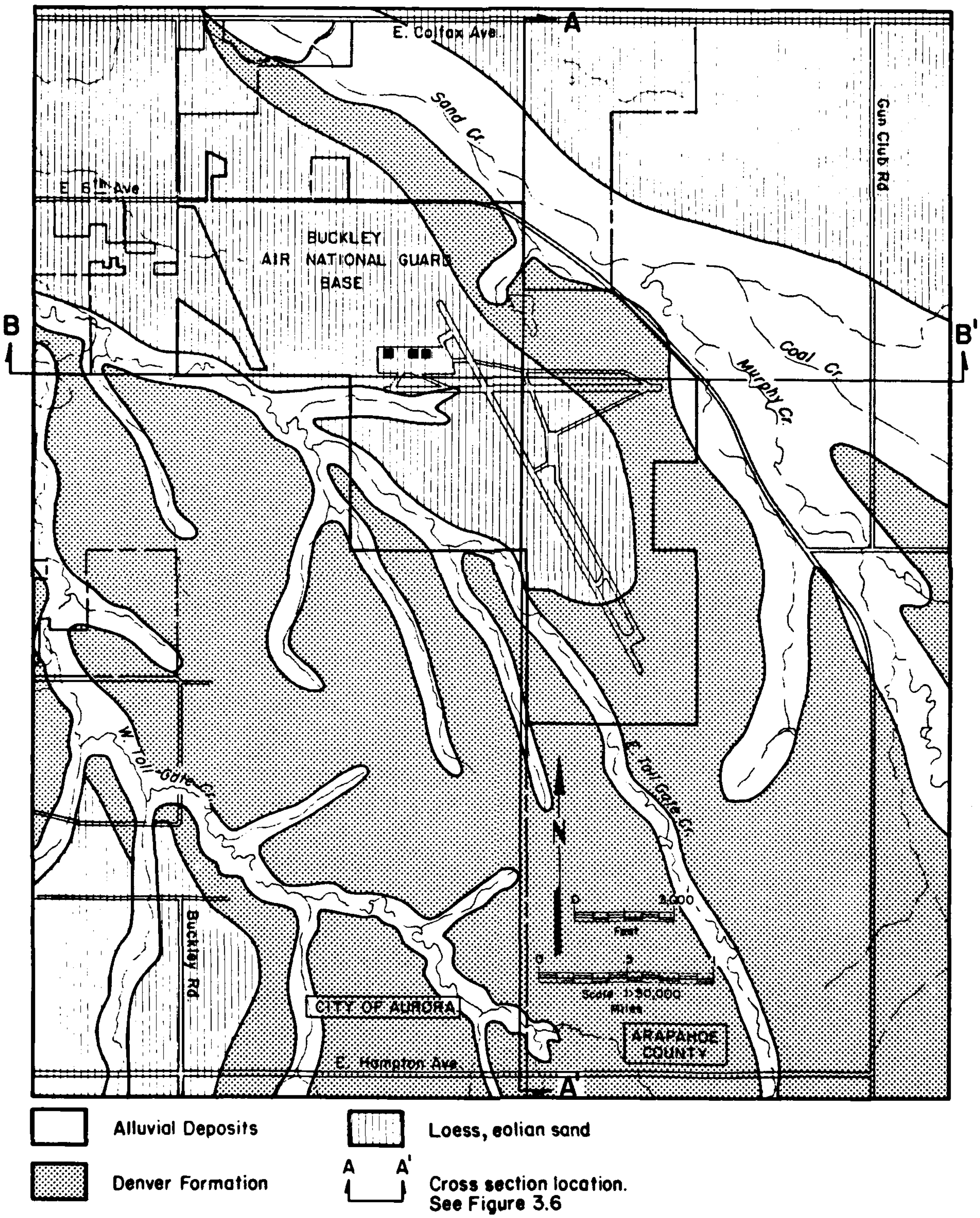
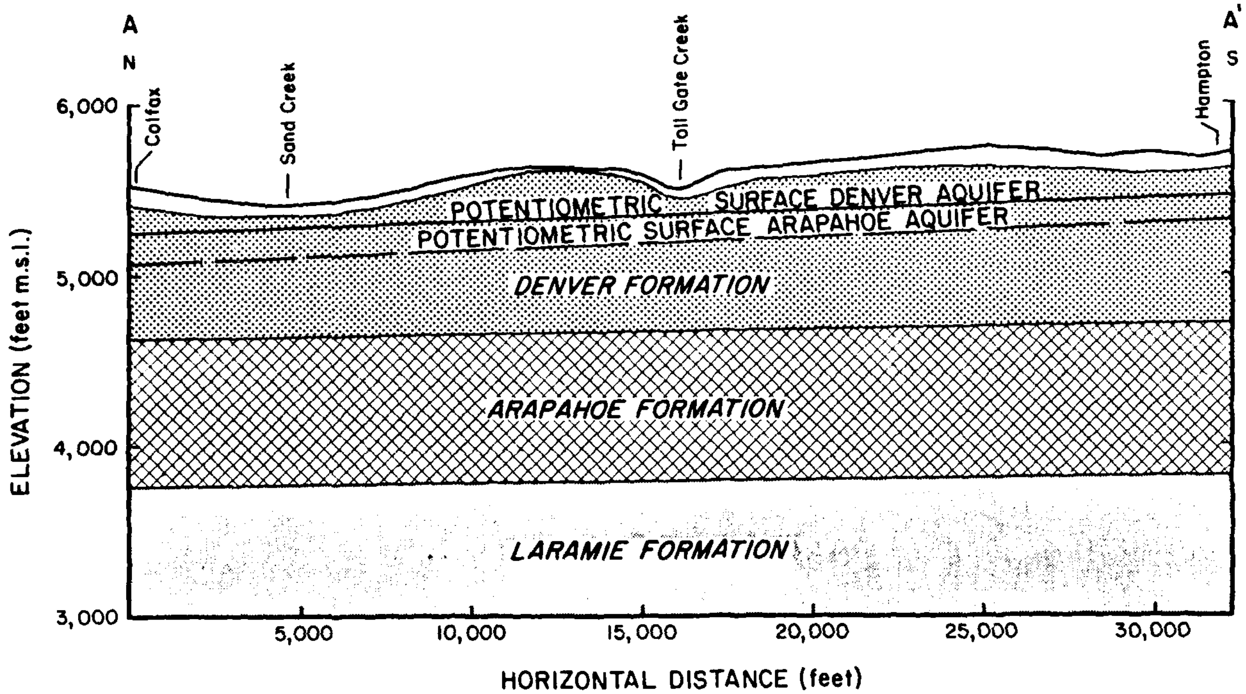


FIGURE 3.4. SURFICIAL GEOLOGY AT BUCKLEY ANG BASE

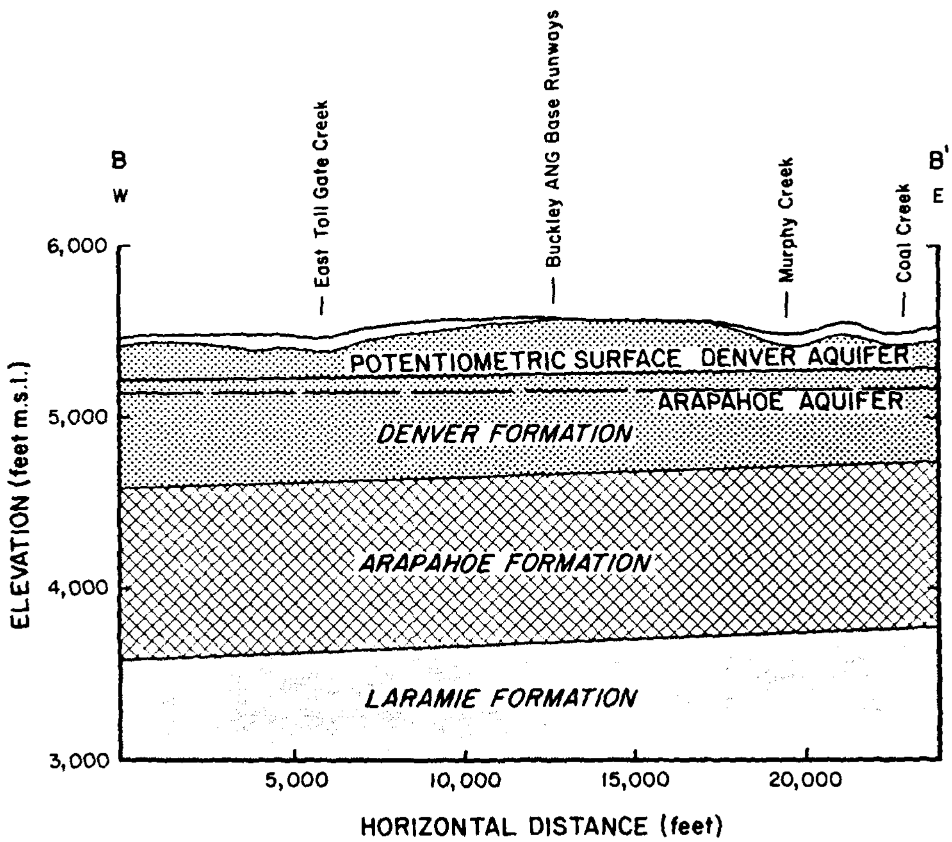
Table 3.3. Description of Surface Geology.

Category		Geologic Unit
Alluvial Deposits	Post-Piney Creek Alluvium	Mostly reworked fairly clean sand and gravel in modern flood plains. Overlain in places by a few feet of dark humus-rich sandy silt
	Piney Creek Alluvium	Well-stratified clay, silt, and sand; contains thin lenses of sand and fine gravel. Forms low terraces about 10 to 25 feet above present stream beds and fills shallow upland valleys. Locally very calcareous
	Broadway Alluvium	Pebbly well-bedded well-sorted granitic gravel. Forms terraces about 25 to 40 feet above stream beds. Pebbles mostly less than 1 inch in diameter.
	Louviers Alluvium	Granitic coarse gravel; contains abundant cobbles, which form thick beds along the principal valleys. Pebbly alluvium with cobble layers near base and deformed silt layers in upper part. In many places stained with iron and manganese.
Windblown Deposits	Eolian sand	Very fine to coarse poorly sorted sand and silt. Forms extensive sand hills, which are generally stabilized.
	Younger loess	Windblown massive, compact silt with some sand lenses. In part reworked by water. Forms vertical cut banks.
Denver Formation		600 to 1,000 foot thick series of interbedded shale, claystone, siltstone and sandstone in which coal and fossilized plant remains are common. Distinguishing characteristics of the formation are its olive, green-gray brown, and tan colors; the presence of coal; and a preponderance of shale and claystone with respect to other rock types. The predominant olive and green-gray colors in the formation are due to the presence of sediments derived from erosion of basaltic and andesitic lavas and distinguish Denver rocks from the generally lighter colored rocks found in the overlying Dawson Arkose and the underlying Arapahoe Formation. In most of the outcrop area along the margins of the aquifer, the formation is exposed at the surface or buried under a thin layer of soil. In other parts of this area, the formation is buried under 10 to 100 feet of sand and gravel deposited in the valleys of the South Platte River and many of the smaller streams crossing the area.



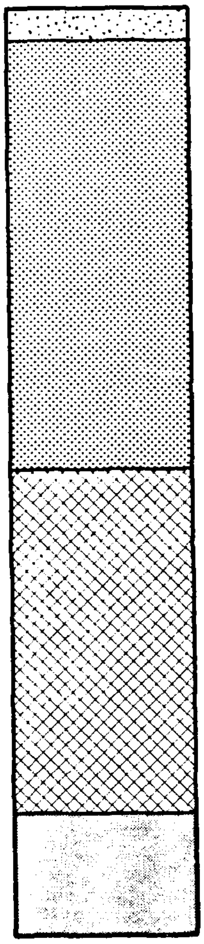
For cross section location see Figure 3.4.

FIGURE 3.5. GEOLOGIC CROSS SECTIONS AT BUCKLEY ANG BASE (ADAPTED FROM ROBSON AND ROMERO, 1981. AND COLORADO STATE ENGINEERS RECORDS)



For cross section location see Figure 3.4.

FIGURE 3.5. CONT.



Not to scale

MATERIAL	THICKNESS (feet)	DEPTH (feet)
Alluvial Deposits	10	10
Broadway, Louviers, Post Piney Creek Alluviums		
Denver Formation		
Clay	23	33
Shale	14	47
Sandy Shale	49	96
Shale	19	115
Sandstone	21	136
Siltstone	97	233
Coal	4	237
Shale and Coal	117	354
Shale and Sand	83	437
Coal and Shale	21	458
Shale	39	497
Clay and Claystone	45	542
Shale and Sand	124	666
Sand	17	683
Shale and Sand	135	818
Arapahoe Formation		
Shale	73	975
Sand	22	997
Shale and Sand	114	1111
Sand	33	1144
Shale and Sand	84	1228
Shale	39	1267
Sand	4	1271
Shale and Sand	129	1400
Laramie Formation		
Shale	30	1430
Sand	90	1520
Coal	29	1549

FIGURE 3.6. TYPICAL WELL LOG AT BUCKLEY ANG BASE

The Arapahoe Formation consists of a 400- to 700-foot thick layer of interbedded conglomerate, sandstone, siltstone and shale. In some areas the formation can be divided into an upper and lower part. The upper part consists of 200 to 300 feet of shale with some conglomerate and sandstone and the lower part consists of predominantly sandstone and conglomerate with some shale. Individual sandstone and conglomerate layers are typically lens-shaped and range in thickness from a few inches to 40 feet. The beds may be so closely spaced that they form a single hydrologic unit 200 to 300 feet thick. An additional 50 to 100 feet of the top of the Laramie Formation are generally included in the Arapahoe Aquifer because this layer functions more as part of the Arapahoe Formation than the Laramie. The thickness of water-bearing layers is about 150 feet near Buckley. The Arapahoe Aquifer is similar to the Denver Aquifer in terms of its complexity and variability.

Groundwater quality is generally good in the Denver and Arapahoe Aquifers, and meets the U.S. Environmental Protection Agency drinking water standards. The water withdrawn from the Denver and Arapahoe Aquifers in the Buckley ANGB area generally has about 200 milligrams per liter (mg/l) of dissolved solids, less than 25 mg/l of dissolved sulfate, and the water is generally soft, with less than 60 mg/l calcium carbonate. Chemical analysis of water drawn from the Buckley deep wells and the Marine well show excessive fluoride, but no other constituents exceed drinking water limits. The water at Buckley is reported to have taste and odor problems. Water drawn from the Laramie and Fox Hills Aquifers may have troublesome amounts of methane and hydrogen sulfide which can cause foul tastes and objectional odors. Laramie-Fox Hills water also has been reported to have excessive iron and fluoride concentrations.

GEOLOGICAL ASPECTS OF POTENTIAL MIGRATION

Groundwater in the Denver and Arapahoe Aquifers generally migrates in a north-northwesterly direction towards troughs along the South Platte River north of Denver. The flow path from Buckley ANGB is generally in the same direction. The potentiometric elevation of the Denver Aquifer was between 150 to 200 feet below the land surface in 1978. The potentiometric elevation of the Arapahoe Aquifer was about 100 feet lower at that time. Since the Denver Aquifer has a higher potential, water can flow downward to the Arapahoe Aquifer as well as laterally. The potentiometric elevation can be equated to

the level of standing water in a well that penetrates the aquifer. A diagram of groundwater flow is given in Figure 3.7 and the potentiometric contours and flow direction of the Denver Aquifer are shown in Figure 3.8. The upper portion of the Denver Aquifer under Buckley ANGB is partially saturated; however, during periods of high groundwater, water flows from springs near the runways at Buckley ANGB.

The groundwater potentiometric elevations were from 50 to 100 feet above the land surface near the center of Denver in the 1880's, allowing artesian flow from the early wells. The water table dropped quickly as the demand for groundwater increased. By 1958 the water table of the Denver Aquifer was about 150 feet lower and the Arapahoe Aquifer had declined over 350 feet in the same period. The completion of Cherry Creek Reservoir in the 1950's provided a major recharge point near Buckley, but the water level continued to drop, and between 1958 and 1978 the Denver Aquifer water table dropped another 100 feet. The Arapahoe Aquifer water table was lowered 200 to 250 feet between 1958 and 1978. Figure 3.9 shows the change in water level in the Denver Aquifer.

Surface and subsurface disposal of hazardous waste material would create the potential for contamination of groundwater wells in the area to the immediate north and northwest of Buckley ANGB (see Figure 3.10). The 40 wells in this area include wells used for domestic and livestock water. The urbanization of the area has caused a decline in groundwater usage due to the availability of city water supplies, but many wells are still in use. Several deeper wells exist in the area and are used for domestic consumption and irrigation. State Engineer records show that over 3,700 wells have been drilled into the Denver Aquifer and over 3,200 wells draw from the Arapahoe Aquifer.

Because the Denver Aquifer water table is higher than the Arapahoe Aquifer, downward migration is possible. Improperly abandoned wells can provide direct access from the surface to the aquifer and can also create direct connections between aquifers.

BIOTA

Buckley ANGB is located on the Colorado high plains and supports wildlife typical for the area. No wetlands or aquatic environments exist at Buckley ANGB. Typical fauna include cottontail rabbits, jackrabbits, prairie dogs, coyotes, deer, pronghorn antelope, mice, snakes and birds. Buckley ANGB is

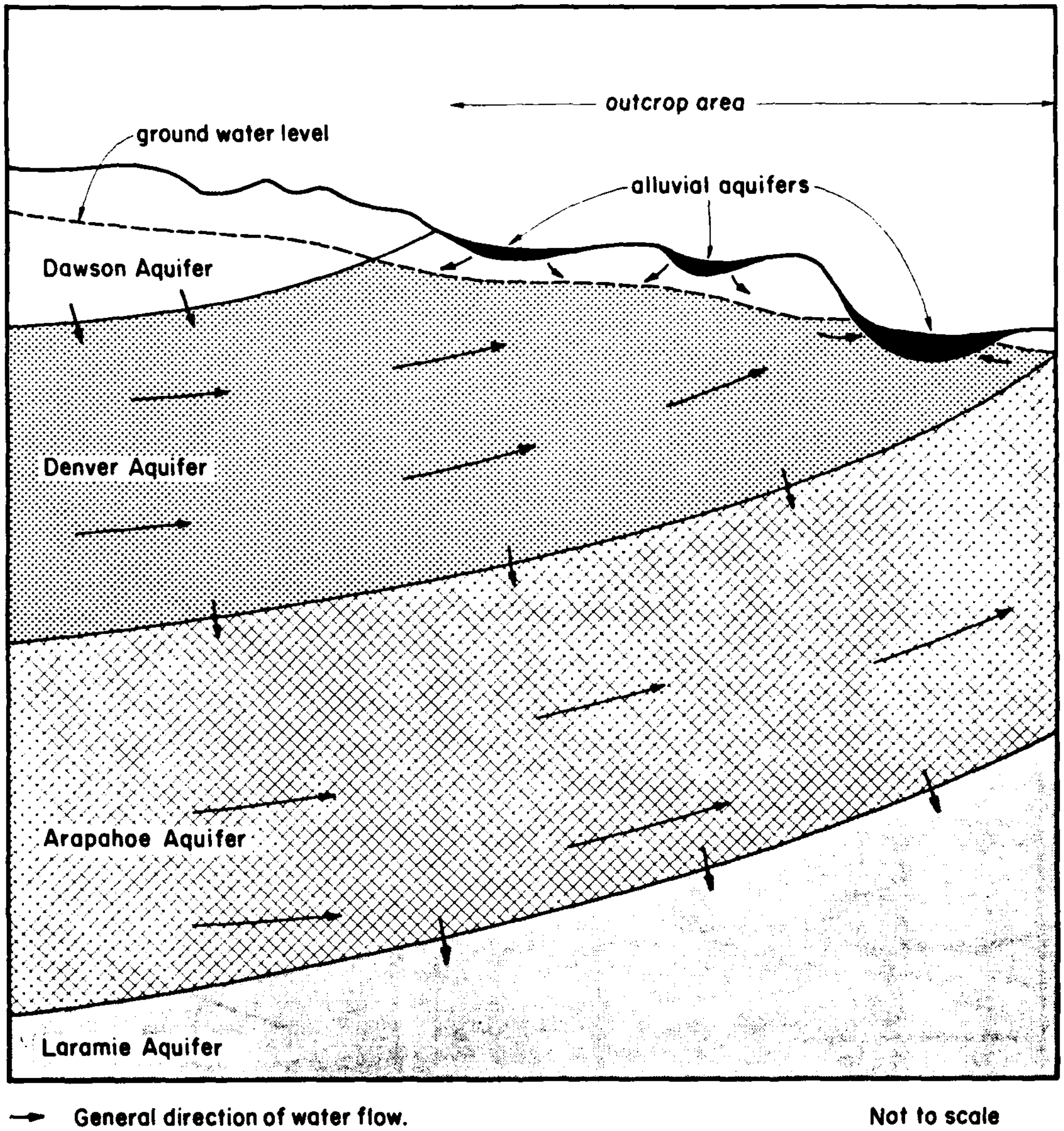


FIGURE 3.7. DIAGRAM OF GROUND WATER FLOW (ADAPTED FROM ROBSON AND ROMERO, 1981).

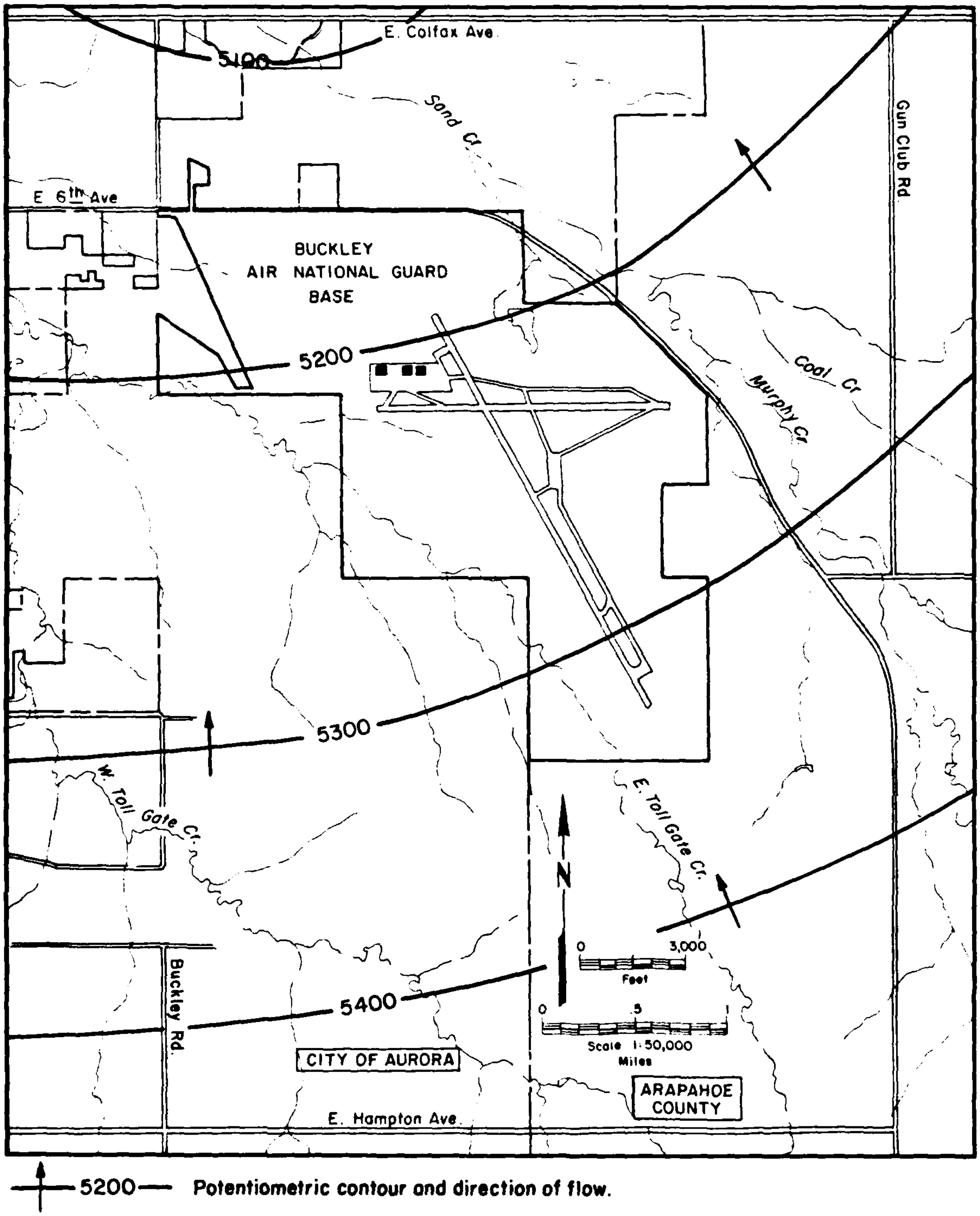
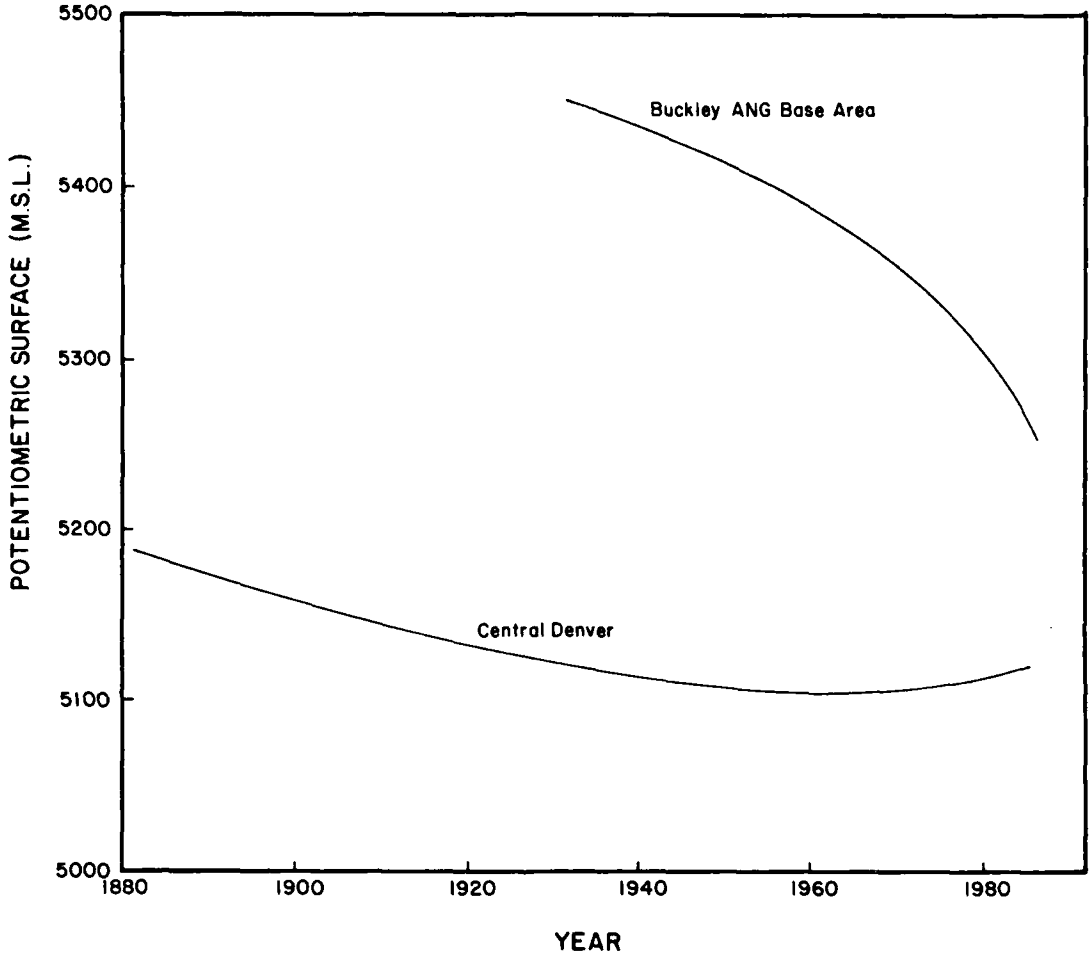
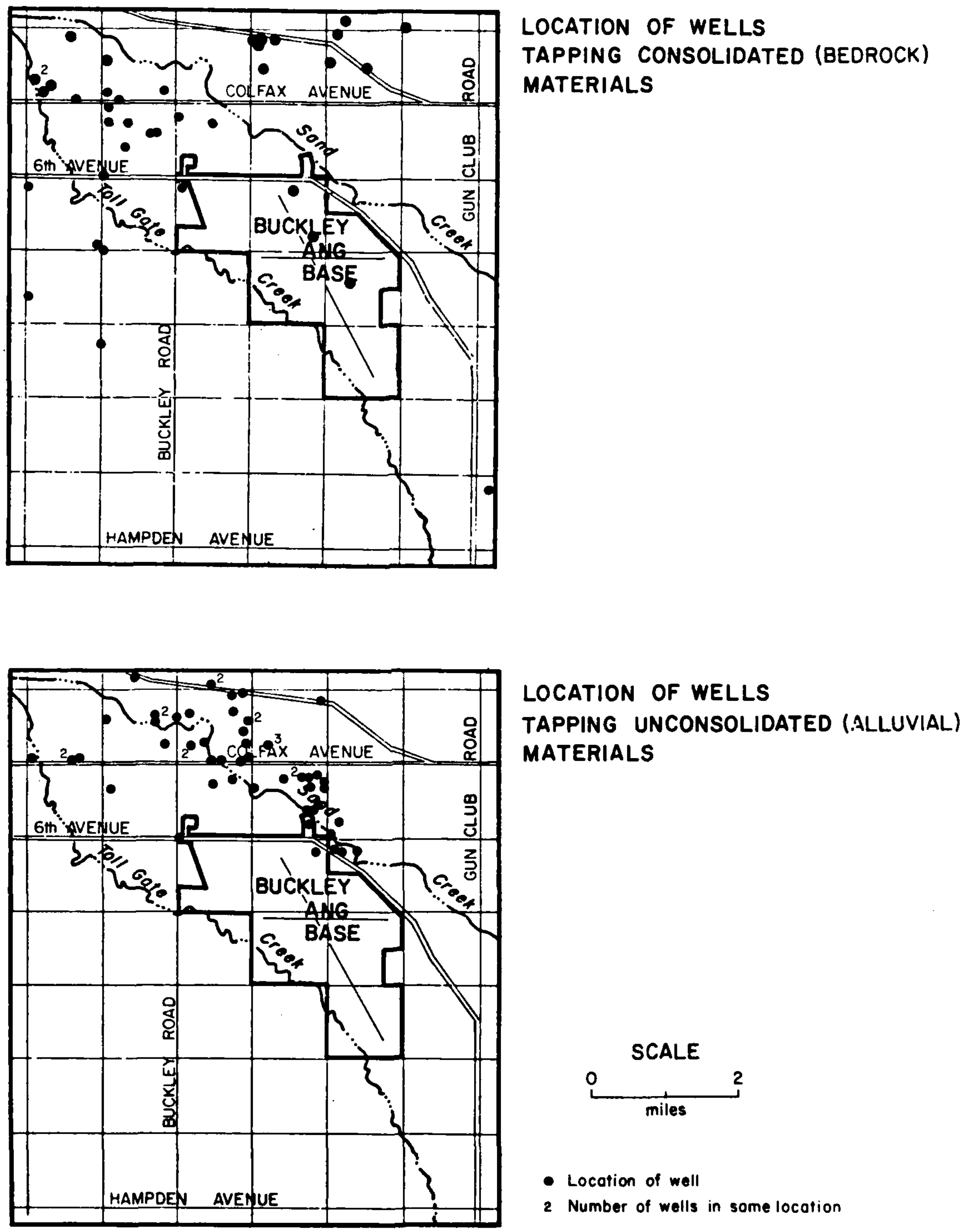


FIGURE 3.8. POTENTIOMETRIC SURFACE OF THE DENVER FORMATION (ADAPTED FROM ROBSON AND ROMERO, 1981)



Source: Robson and Romero (1981)
Emmons (1896)

FIGURE 3.9. WATER LEVEL CHANGE IN THE DENVER AQUIFER



Source: Colorado State Engineer

FIGURE 3.10. LOCATIONS OF RECORDED WELLS IN THE BUCKLEY ANG BASE AREA

within the historical range of the black-footed ferret, *Mustela nigripes*, but no sightings have been recorded at or near Buckley in over 15 years.

The majority of Buckley ANGB is prairie grassland. Native species include Big and Little Bluestem, Buffalo and Gramma grasses. The only native trees are plains cottonwood and some willows. Many introduced species exist at Buckley, including Bluegrass and Elm Trees. A more detailed description of biota is included in Appendix D.

CHAPTER IV

FINDINGS

CHAPTER IV
FINDINGS

To assess hazardous material/waste management at Buckley ANGB, material/waste generation and disposal methods were reviewed. This chapter summarizes the hazardous material/waste generated by activity, describes disposal methods, identifies the disposal sites located on the base, and evaluates the potential for contaminant migration. Figure 4.1 presents the decision-tree methodology used in the review of waste practices. The methodology provides a logical algorithm for the consistent evaluation of all base practices.

PAST SHOP AND BASE ACTIVITY REVIEW

To identify base activities that have resulted in generation and disposal of hazardous waste or materials, a review of current and past material/waste generation and disposal methods was conducted. This review consisted of interviews with base employees, a search of files and records, and site inspections.

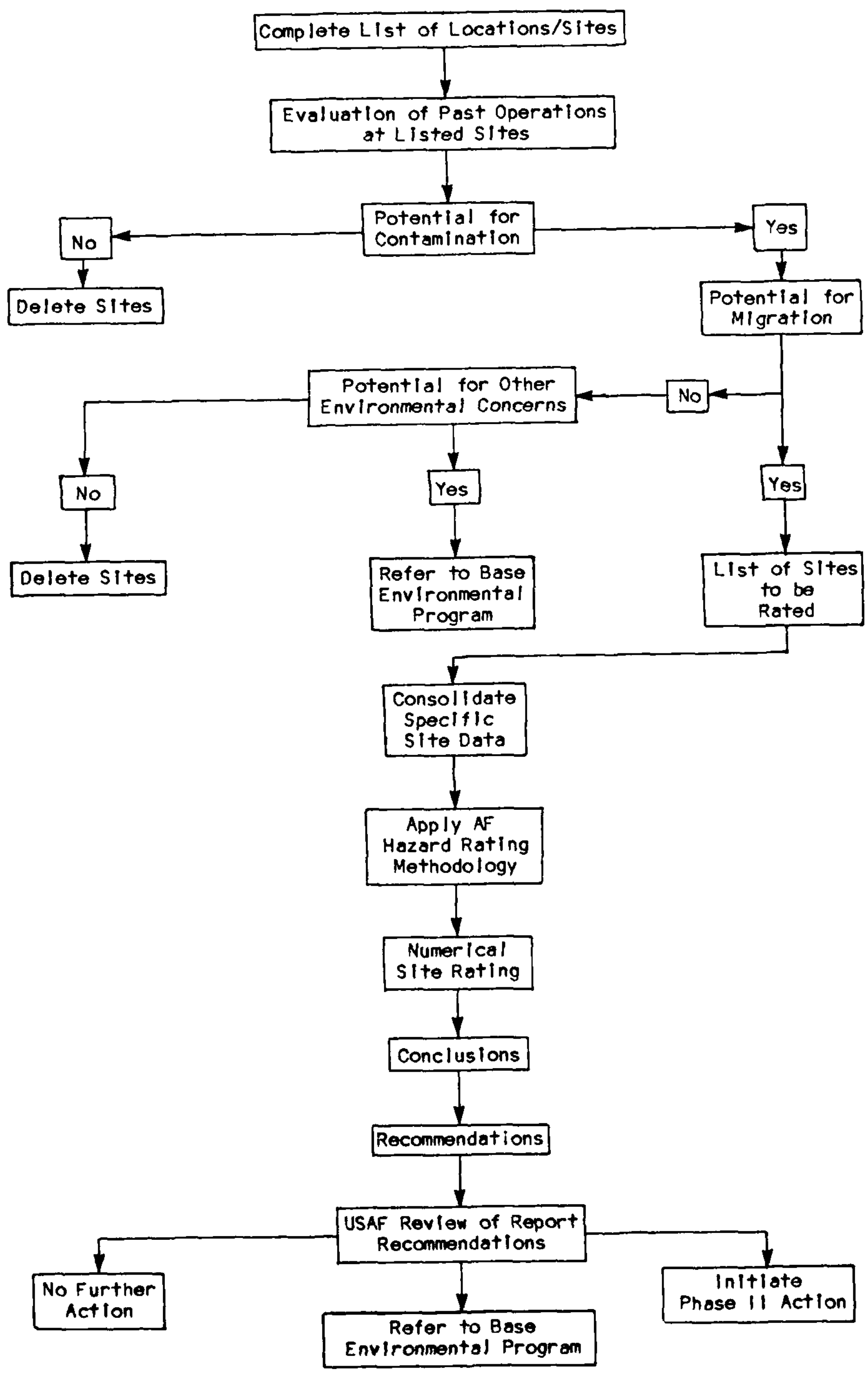
The sources of most hazardous wastes that are generated on Buckley ANGB can be associated with one of the following activities:

- Maintenance shops
- Fire control utilization
- Pesticide utilization
- Fuels management

The following discussion addresses only those wastes generated on the base which are either hazardous or potentially hazardous. In this discussion, the term hazardous waste is used as it is defined by Resource Conservation and Recovery Act of 1976 (RCRA) or by the Buckley ANGB documents which have been reviewed. A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the waste material.

Activities at Buckley ANGB include aircraft and ground-vehicle maintenance, fuel storage and dispensing, operation of utility systems, and general base maintenance activities. The shop records of the Environmental

DECISION TREE



Phase I Installation Restoration Program

FIGURE 4.1. RECORD SEARCH METHODOLOGY

Health Officer were reviewed and interviews were conducted with personnel familiar with the various activities in order to assess hazardous waste generation and disposal practices. A summary of hazardous material usage and disposal practices is given in Table 4.1.

<u>140th Tactical Fighter Wing</u>

The 140th Tactical Fighter Wing performs all types of aircraft maintenance on the A-7 aircraft stationed at Buckley ANGB. Maintenance operations generate waste in the form of waste solvents, contaminated fuels and hydraulic fluids, degreasers, dye penetrants, and other associated materials. Solvents used at Buckley ANGB include PD-680, 1,1,1-Trichloethane, methyl ethyl ketone, and acetone. Trichloethylene and possibly other chlorinated hydrocarbons were used in the past. Avionic and instrument repair is generally limited to switching component parts. No electroplating is conducted at Buckley ANGB, nor were any records found to indicate any electroplating operations in the past. The 140th Tactical Fighter Wing currently flies A-7 aircraft and in the past has flown F-100, F-86, F-84, and P-51 aircraft. Maintenance activities for the jet aircraft are essentially the same. No records were found to indicate specific types of hazardous materials used and interviews did not reveal any substantial differences from current practices. Fuel cell repairs are done in Building 800, as is spot painting of aircraft, general corrosion control, and stripping. De-icing is generally done in Building 800, but is occasionally done on the ramp area. Painting operations involve the use of strippers such as toluene. Phenolic paint strippers were used in the past. Zinc chromate primers are used and paints include lacquers and polyurethane paint.

Currently, all solvents, used oils, and other fluids associated with aircraft maintenance are stored in portable storage tanks and turned into Supply for disposal through the Defense Property Disposal Office (DPDO) in Fort Carson. Small spills are either washed to the storm drainage system in the area of Building 801 or treated with absorbent materials and swept up. No major spills of solvents, oil, or other fluids were reported. JP-4 contaminated with water is transferred to the fire department for use in training exercises.

Table 4.1. Summary of Hazardous Material Usage and Disposal Practices at Maintenance Shops.

Shop Name	Location (Bldg. No.)	Waste Material	Waste Quantity*	Disposal Methods 1950---------1960---------1970---------1980----
Aerospace Ground Equipment	814	Motor oils Hydraulic fluids Paint remover	50 gal/month 30 gal/month 4 gal/month	Fire Dept / Roads & Ground → Waste oil holding tank →
		PD-680, Type II	75 gal/month	Flushed to sanitary sewer →
		Trichloethylene	1 gal/month	Evaporates →
		Primer Enamels Lacquers (spray cans)	1 gal/month 2 gal/month 16 gal/month	Base Dump → Contractor off base →
		Sulfuric acid	10 gal/month	Neutralize and flush → Stored →
Aircraft Maintenance	801	Primer Phenolic stripper	2 gal/month 2 gal/month	Base Dump — Contractor off base →
Fuel Cell/Corrosion Control Maintenance	800	Aircraft cleaning compounds	55 gal/month	San. Sewer →

* Includes evaporation and spillage.

Table 4.1 continued.

Shop Name	Location (Bldg. No.)	Waste Material	Waste Quantity*	Disposal Methods 1950---------1960---------1970---------1980----
		Methyl Ethyl Ketone (MEK)	50 gal/month	
		Epoxy primer	8 gal/month	
		Lacquer thinner	6 gal/month	
		Toluene	1 gal/month	Waste oil holding tank →
		Polyurethane	18 gal/month	
		Lacquers	4 gal/month	
		Enamels	1/2 gal/month	
		Acetone	5 gal/month	
Electrical/ Environmental Shop	801	Strippers		
		Cleaners	2 gal/month	Waste oil holding tank →
Non-Destructive Inspection	801	Zyglow	2 gal/month	Fire Dept → Waste oil holding tank →
		Engine oil	5 gal/month	Roads & Grounds
		Developer, aqueous	1 gal/month	Flushed to sanitary sewer →
		Fixer	1 gal/month	Flushed to sanitary sewer → Reclaimed →
		Magnetic Inspection compound (spray)	4 can/month	Base Dump → Contractor →
		Penetrants	10 gal/month	Recycled →
		Developer, non-aqueous	20 can/month	Base Dump → Contractor →

Table 4.1 continued.

Shop Name	Location (Bldg. No.)	Waste Material	Waste Quantity*	Disposal Methods 1950----1960----1970----1980----
Tire Shop	801	PD-680	45 gal/month	
		Alkaline dip	45 gal/month	
		Zinc chromate	15 gal/month	Waste oil holding tank →
		MEK	1 gal/month	
		Toluene	1 gal/month	
		Lacquer	12 can/month	Base Dump; Contractor →
Motor Pool	940	Paint	12 gal/month	
		Lacquer thinner	12 gal/*month*	
		Paint remover	12 gal/month	Fire Dept Roads & Grounds; Waste oil holding tank →
		Hydraulic fluids	1 gal/month	
		Stoddard solvent	100 gal/month	
		Lubricating oils	20 gal/month	
		Asbestos brake pads	20 pads/year	Base Dump; Contractor →
Photo Laboratory	801	Developer	4 gal/month	Flushed to sanitary sewer →
		Fixer	4 gal/month	Flushed to sanitary sewer; Reclaimed →
		Acetic acid	1 gal/month	Flushed to sanitary sewer →

Table 4.1 continued.

Shop Name	Location (Bldg. No.)	Waste Material	Waste Quantity*	Disposal Methods 1950---------1960---------1970---------1980----
Aircraft Engine Shop/Test Cell	960	JP-4	100 gal/month	
		Synthetic oil	10 gal/month	
		PD-680	20 gal/month	
		MEK	1 gal/month	
		Carbon removing Compound	5 gal/month	Fire Dept / Roads & Grounds → Waste oil holding tank
		Xylene	5 gal/month	
		Paint remover	1 gal/month	
		Lacquer	12 can/month	Base Dump → Contractor
Structural Repair	801	Toluene		
		MEK	1 gal/month	Waste oil holding tank
		Lacquer thinner		
		Acid cleaner	1 gal/month	Neutralize and flush to sanitary sewer
Transient Aircraft Maintenance	909	PD-680	40 gal/month	
		JP-4	50 gal/month	Fire Dept / Roads & Grounds → Waste oil holding tank
		Synthetic oil	1 gal/month	
		Hydraulic fluid	1 gal/month	

Table 4.1 continued.

Shop Name	Location (Bldg. No.)	Waste Material	Waste Quantity*	Disposal Methods 1950----1960----1970----1980----
Army Aviation Support Facility	1500	PD-680 Synthetic oil Hydraulic fluid	10 gal/month 10 gal/month 1 gal/month	Waste oil holding tank
Civil Engineering Shops				
Paint Shop	711	Paint	10 can/month	Base Dump → Contractor
		Thinner Toluene MEK	1 gal/month 1 gal/month 1 gal/month	Waste oil holding tank
Plumbing Shop	711	Fuel tank sludge Fuel filters	500 lb/year	Base Dump → Contractor
Other Shops		Included in Motor Pool		

Prior to 1981, waste fluids were stored in an underground fuel tank near Building 815. The possible incompatability of the contents led to segregation in drums. The contents of the underground tank were analyzed and found to contain water, solvents, fuels and used oil. The contents will be disposed of by contract. In the past, used solvents, oils, and contaminated fuels were all stored together in the underground tank. The fire department used the contents of the tank for training fires.

It was reported that during the years of Navy operation, the fluids were used to aid in the burning of trash in the base dump. Used oil was also dumped into a pit located southeast of the Civil Engineering shops. The pit is enclosed by concrete walls, but it is not known if the pit is lined at the bottom. The oil pit is currently filled with several feet of what appears to be fresh oil.

Transient Aircraft Maintenance

Transient aircraft maintenance is performed in Building 909. Up to 10,000 aircraft of all types are serviced each year. Maintenance is generally flight-line maintenance and does not include heavy airframe or power plant maintenance, but occasional spot painting is done. A hazard associated with transient F-16 aircraft is the possibility of hydrazine spills. Hydrazine is a powerful oxidizer used in the emergency power units of F-16 aircraft. One incident of a worker coming in contact with hydrazine fumes was reported. Contaminated fuels are turned over to the Fire Department, and hazardous wastes are turned into Supply.

Tenant Aircraft Maintenance

Aircraft maintenance is performed by the U.S. Army Readiness Region VIII and the Marine Reserve on several twin-engine propellor planes in Building 909. Wastes generated are small and limited to the same types of materials used in other aircraft maintenance operations. The Army National Guard operates the Army Aviation Support Facility (AASF) located in Building 1500. Maintenance performed at the AASF includes engine overhauls and airframe maintenance on the helicopters assigned to Company D, 40th Aviation Attack Helicopter Battalion. Hazardous material usage

is limited to the same types of materials used in other aircraft maintenance operations. Contaminated fuels are turned over to the Fire Department.

Ground Vehicle Maintenance

Ground vehicle maintenance is performed in the Motor Pool (Bui ing 940), the Civil Engineering shops (Building 710), the Aerospace Ground Equipment shop (Building 814), and in the Marine Motor Pool (Building 518). Compounds used in vehicle maintenance include paints, paint thinners, ethylene glycol, various hydraulic fluids, battery acid, solvents, and cleaning compounds. Used battery acid is stored in plastic drums outside Building 940. Waste solvents and oil are turned into Supply.

In the past, materials were stored in the underground tank near Building 815. Used oil was utilized for dust control on dirt roads.

Utilities

The water system consists of several deep wells, a concrete storage tank, treatment facility, pumping stations, and a distribution system. Chemicals on hand at the water treatment plant (Building 906) include laboratory reagents and chlorine compounds.

The electric distribution system consists of overhead transmission lines and transformers. All electric transformers at Buckley ANGB have been analyzed for polychlorinated biphenyls (PCB's). One incident involving a PCB spill occurred in 1981. A pyrenol containing transformer located in Building 801 leaked small amounts of cooling fluid. The spill was contained and cleaned according to Environmental Protection Agency (EPA) regulations. All contaminated material was disposed of off base by contract. In the late 1960's, a line transformer exploded near Building 801. The debris was cleaned up and disposed of in the base dump. The transformer may have contained PCB's, but the PCB concentration was probably less than 100 parts per million (ppm) as evidenced by the laboratory analysis of 93 other line transformers (see Appendix G). The only PCB containing transformers still in use are in the area of the control tower and are inspected regularly.

Steam is generated in the base heating plant, Building 903. Natural gas is used to fire the boiler and fuel oil (#6) is used as a standby. The heating plant originally used coal-fired boilers, but was converted to fuel

oil after World War II. The coal storage area was located near Building 549. Fuel oil is stored in four 12,000 gallon underground tanks adjacent to Building 903. Boiler water is acidified prior to heating. Boilers are blown down approximately three times per day. The blowdown water is treated with sodium sulphite, allowed to cool, and discharged to the sanitary sewer system.

Fuels Management

Fuels stored and dispensed at Buckley ANGB include JP-4 jet fuel, No. 2 diesel fuel, avgas 130, and mogas (regular and unleaded). JP-4 is stored in above-ground tanks (Building 200), pumped into tank trucks, and dispensed directly to aircraft. The AASF has its own 15,000 gallon underground storage tank near Building 1500. Avgas 130 is stored in a tank truck and dispensed to aircraft. Diesel fuel is stored near Building 601. Mogas is stored and dispensed at the base gas station, Building 729. Petroleum and synthetic lubricating oils are used in both aircraft and ground vehicles.

An old aquasystem fuel storage tank was located in the vicinity of the present Building 800. Use of this tank was discontinued due to leakage problems. Existing underground storage tanks and fuel lines have not experienced any serious problems with leakage. Fuel spills have involved small quantities and no spill in excess of 100 gallons has occurred, according to base personnel. Fuel spills that cover an area greater than 10 square feet are washed to storm sewers by the fire department. Fuel tanks are cleaned and all sludges taken off the base by outside contractors; however, in the past, fuel tank sludges including avgas sludge were taken to the base dump and spread on the ground. Approximately one ton of sludge every few years was deposited in the base dump from the 1940's until the late 1960's. Filters were also deposited in the dump in this period.

Pesticide Utilization

Pesticides have been used at Buckley ANGB since World War II. Records indicate that DDT was used during the period from 1942 until the late 1950's. Other compounds used included silvex.

Compounds currently used include 2,4-D, Malathion, pyrethrins, and zinc phosphide. Insect control has been contracted for the last five years. Approximately 100 pounds of oats containing two percent zinc phosphide are applied annually for rodent control. 2,4-D is used for weed control and empty

drums are turned into Supply. Spray cans of pyrethrins are used for pest control and empty cans are disposed of as general refuse. In the past, empty pesticide containers were disposed of in the base dump.

A large quantity of DDT was until recently stored at Buckley ANGB, but was removed and destroyed by contract in November 1981. Records of the disposal of DDT are included in Appendix G.

Laboratory Operations

A small clinical laboratory is located in Building 33. The laboratory performs routine clinical functions and X-ray development. Most wastes are disposed of in the sanitary sewer system. X-ray developers and fixers are sent to DPDO in Fort Carson for silver recovery.

A fuels laboratory is located in Building 300. Laboratory wastes are collected in a holding tank and turned into Supply.

Classified communication and electronic research is conducted at the Aerospace Data Facility (ADF). Standby power generation is provided by six 1,000-horsepower diesel engines. A total of 84,000 gallons of diesel fuel is stored in underground tanks within the facility. An acid solution is used as a biocide in the cooling tower. Chromate was used in the past as a biocide. Condensate is discharged to the storm drainage system.

The Non-Destructive Inspection Laboratory is located in Building 801. Compounds used include dye penetrants, developers, solvents, and X-ray developers and fixers. X-ray developers and fixers are sent to DPDO in Fort Carson for silver recovery.

The base photo laboratory is located in Building 801. Most solutions are disposed of in the sanitary sewer system. Developers and fixers are sent to DPDO.

Weapons Training Areas

Weapons training is conducted at Fort Carson near Colorado Springs or at the National Guard Range near Guernsey, Wyoming. Small arms training is conducted at the Buckley ANG Range near Building 1111. Explosive ordnance disposal (EOD) is currently done at Fort Carson or the Rocky Mountain Arsenal. EOD was previously conducted near Building 1111, but was limited to relatively small ordnance.

Fire Protection Training

Fire protection training (FPT) activities of the fire department at Buckley ANGB commenced in the 1940's. Since that time, three fire training areas (FTA) have been used as shown in Figure 4.2. FTA No. 1 is located near the abandoned reservoir and was operational during the late 1940's and early 1950's. Avgas was burned at this site. FTA No. 2 is located near the control tower area and was operated from the early 1950's until 1972. Materials burned at this site included avgas and JP-4. FTA No. 3 is located west of Building 801 and operation began in 1972. The procedure is to first add water to the area to reduce infiltration and then add water-contaminated JP-4 and ignite the fuel. The fire is extinguished with water and six percent aqueous film forming foam (AFFF). About 150 gallons of fuel are used during each exercise. Approximately 400 gallons of AFFF are used annually, and about 24 exercises are conducted each year. Fire department personnel estimate that approximately 50 to 70 percent of the fuel is burned during the exercise. Procedures at FTA No. 2 were said to be similar except that a protein-based foam is used.

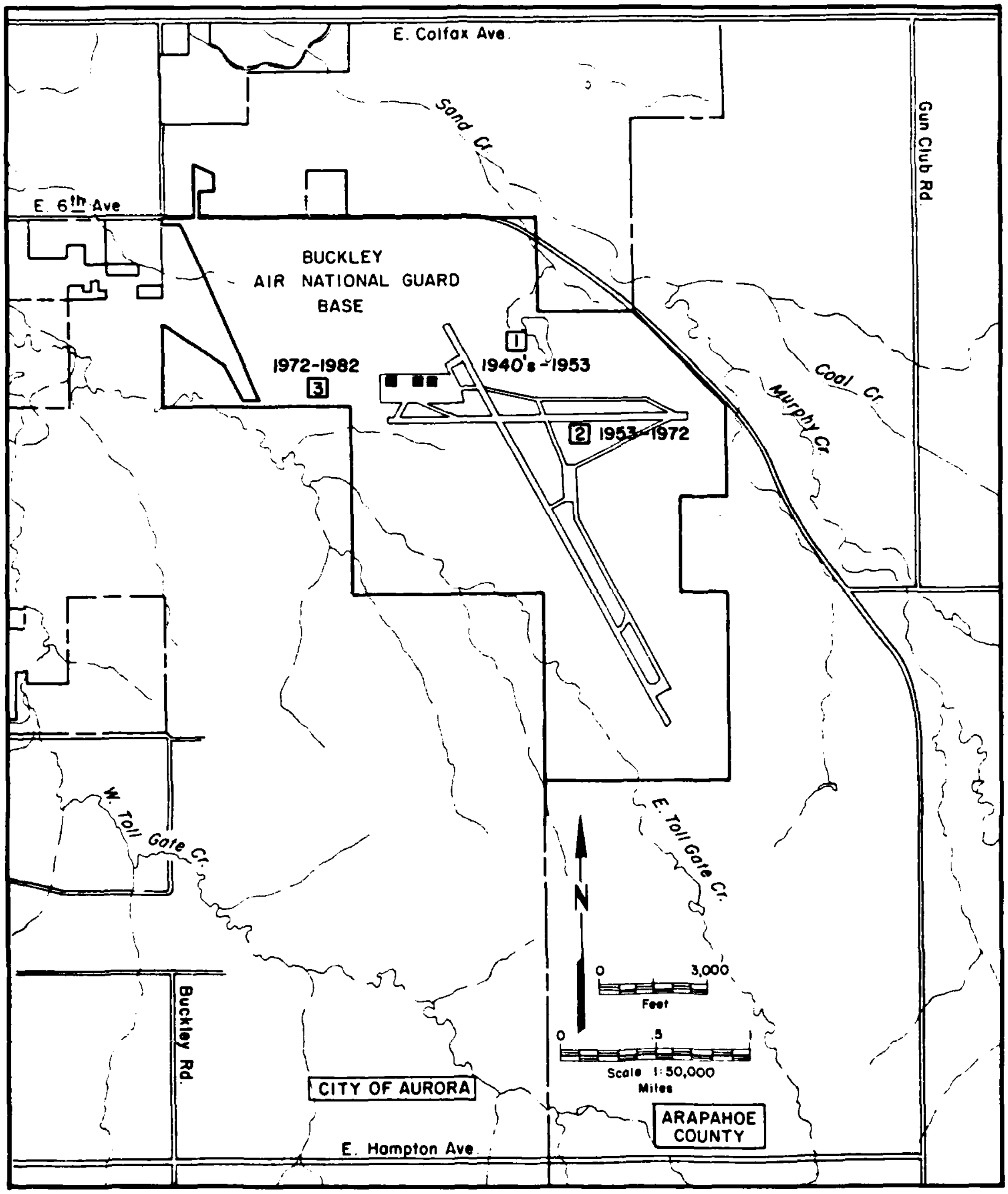
The contaminated JP-4 is stored in 55-gallon drums adjacent to the fire training area. Only JP-4 is burned during the training exercises, but in the past, flammable materials were obtained from the waste oil holding tank and may have contained motor oil, solvents, and other materials.

All three FTA's are undiked and unlined. Residual materials either evaporate, infiltrate or are washed away by stormwater runoff.

DESCRIPTION OF PAST ON-SITE DISPOSAL METHODS

The on-site facilities which have been used for management and disposal of waste can be categorized as follows:

- Landfills
- Oil pit
- Sanitary wastewater facilities
- Storm sewer system
- Industrial wastewater treatment
- Ordnance disposal site



3 1972-1982 Location of Fire Training Area and dates of operation

FIGURE 4.2. FIRE TRAINING AREAS

These sites are discussed individually below and locations are given in Figure 4.3.

Landfills

The base dump is located adjacent to East Toll Gate Creek near the west installation boundary. The dump has been in operation since 1942. Materials known to have been disposed of in the dump include building materials, paint cans, pesticide containers, scrap paper and other municipal refuse, fuel tank sludges, and construction rubble. Municipal refuse from Buckley ANGB was deposited in the dump from 1942 until about 1968. Municipal refuse from nearby Lowry Air Force Base was disposed of in the dump during the early 1960's. During the period of Navy occupation (1947-1959) and possibly for several years thereafter, the dump was periodically burned to reduce blowing paper and debris. Waste oils and probably other flammable materials were spread on the refuse to aid burning. The method of operation was to dig a trench, fill the trench with waste materials, cover with earth, and dig a new trench.

Many materials are exposed in the dump, including paint and paint cans, empty solvent containers, building materials, and scrap metal. There is also an area where oil/fuel has been dumped, a 55-gallon drum of tar has spilled onto the ground, and construction rubble. Several empty 55-gallon drums have been carried off of the base by flows in East Toll Gate Creek.

The dump extends from the installation boundary on the west to approximately 3,000 feet east along East Toll Gate Creek. Materials have been observed along both banks of the creek. The soils in the area are relatively impermeable, but are subject to erosion. The dump lies within the flood plain of East Toll Gate Creek and the dump has been under water on at least one occasion (1965). Parts of the dump extend into the creek channel as evidenced by materials present in the creek bed. East Toll Gate Creek has high, nearly vertical banks downstream of the base. The channel bed may undergo additional degradation in the future and create additional bank instability. The creek is normally dry and only flows following precipitation events. The groundwater table is variable, but generally is about five feet below the creek bed.

During World War II, the Army disposed of scrap airplane parts in an area east of the control tower. Scrap wing tanks and other parts were placed in this area. In one reported incident, the remains of a crashed aircraft were

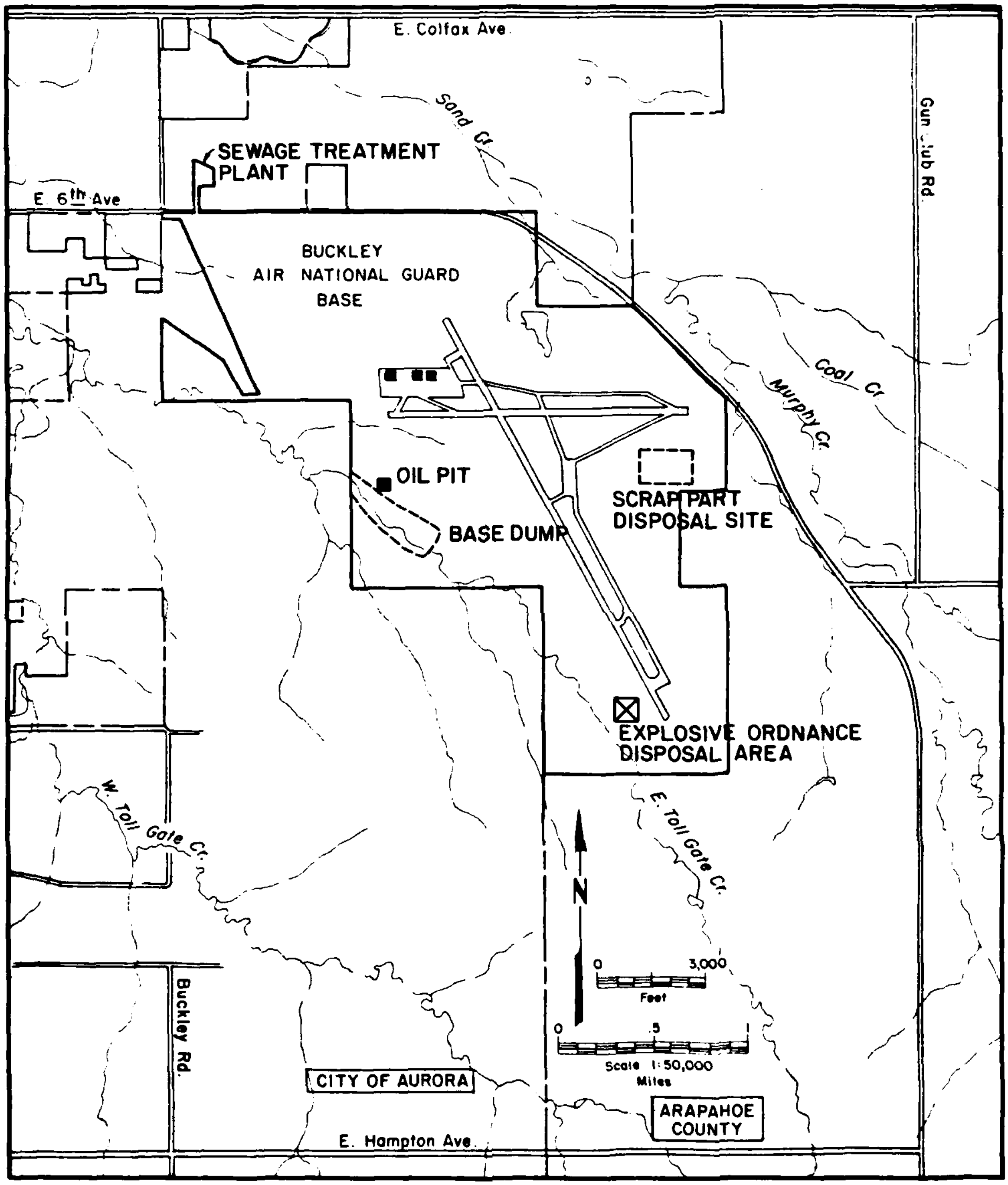


FIGURE 4.3. WASTE MANAGEMENT AND DISPOSAL FACILITIES

buried in this area. A possibility exists that small amounts of low-level radioactive materials could have been deposited at this location. The radioactive materials would be in the form of radium sulfide paints or electron source tubes. No evidence exists to indicate the exact location of this site.

Following World War II, many buildings were salvaged and the foundations bulldozed into excavated pits and covered. Exact locations are unknown, but the sites are not suspected to contain any hazardous materials.

Oil Pit

The oil pit is located adjacent to the base dump southeast of Building 711. The pit is approximately 10 feet square and is enclosed by concrete walls. Standing oil several feet deep is present in the pit, and appears to be recently deposited. It is not known if the bottom of the pit is lined. According to interviews, the contents of the oil pit were occasionally burned in the 1950's. The types of materials disposed of in the pit other than oil are not known. Any oil deposited in the pit is against current base practices.

Waste Water

A wastewater treatment plant was constructed in 1942. It consisted of bar screens, a primary clarifier, a trickling filter, a sludge digester, chlorine contact chambers, and sludge drying beds. The design flow of the plant was approximately one million gallons per day, but actual flows were much less. The treated effluent was discharged to Sand Creek. The sludge drying beds were designed with a filtrate collection system, but the clay tiles comprising the collection system collapsed early in the life of the plant. Sludge accumulation was relatively small and the drying beds were rarely cleaned. The plant was subject to occasional slugs of chemical-type waste.

The sludge-digester roof collapsed in 1978 and the plant was closed. Sanitary wastewater was discharged to the City of Aurora's collection system and treated at the Metropolitan Denver Sewage Disposal District Plant No. 1. City of Aurora personnel have reported that chemical odors are almost always present in the connection to the Buckley ANGB sewer system.

Sludge from municipal treatment works has been exempted from EPA hazardous waste regulations. Sludge typically contains trace amounts of heavy metals such as lead and cadmium. Sludge at Buckley ANGB could also contain non-biodegradable substances from maintenance activities as indicated by the presence of chemical odors. A potential for contamination exists in the sludge drying bed area due to heavy metal accumulation in the beds during the period of operation (1942-1978).

Areas south of the east-west runway are served by septic tanks. All septic tanks meet State of Colorado regulations regarding distance from water wells. Typical design of leach fields for septic tanks in relatively impervious soils involves the use of evapotranspiration systems. These systems use leach fields that are constructed close enough to the ground surface to allow evaporation and transpiration by the vegetative cover.

Stormwater Drainage

Stormwater is collected in a system of pipes, culverts, and open ditches and discharged to Sand Creek and East Toll Gate Creek. Drainage east of the north-south runway flows to Sand Creek and drainage west of the runway flows to East Toll Gate Creek. Spills are generally washed to the nearest stormwater collector.

In the past, aircraft were washed and painted on the apron south of Building 801. The apron was washed with water which flowed off the south and west edges of the apron. The wastewater either infiltrated at this location or entered a drainage ditch and flowed off the base. The types of materials washed off the apron in the past include fuels, cleaning compounds, ethylene glycol, paints, and strippers.

Industrial Wastewater Treatment

Industrial wastewaters are pretreated by oil/water separators at four sites at Buckley ANGB. These separators are located in the base gas station (Building 729), motor pool (Building 940), the Civil Engineering shops (Building 710), and the fuel system maintenance dock (Building 800). Pretreated wastewater is discharged to the sanitary sewer system except for wastewater from Building 710, which discharges to a septic tank. Separated

oil and grease are contained in holding tanks which are periodically pumped to 55-gallon drums and sent to Supply for reclamation through DPDO.

ORDNANCE DISPOSAL SITES

Currently there are no ordnance disposal operations conducted at Buckley. The only weapons used are small arms, and use is confined to the small arms range. In the past, a variety of weapons were used in training operations and EOD was conducted south of the small arms range. The area has been repeatedly policed by demolition personnel for remaining live rounds. Nevertheless, a possibility exists that unexploded ordnance remains in the area that could be uncovered by erosion.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

The review of past operation and maintenance functions and past waste management practices at Buckley ANGB have resulted in the identification of eight sites containing hazardous waste materials that have the potential for migration of contamination. Other sites were reviewed and eliminated from further evaluation based on the logic presented in the decision tree shown in Figure 4.1.

The eight sites have been assessed using a hazard assessment rating methodology (HARM), which takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. The details of the rating procedures are presented in Appendix I and the results of the assessment are summarized in Table 4.2. The HARM system is designed to indicate the relative need for follow-on action. The information presented in Table 4.3 is intended as a guide for assigning priorities for further evaluation of the Buckley ANGB disposal areas (Chapter V, Conclusions and Chapter VI, Recommendations). The rating forms for the individual waste disposal sites on Buckley ANGB are presented in Appendix J. Photographs of some of the key disposal sites are contained in Appendix F.

Table 4.2. Summary of HARM Scores for Potential Contamination Sources.

Rank	Site Name	Receptor Subscore	Waste Characteristic Subscore	Pathways Subscore	Waste Management Factor	Overall Total Score
1	Fire Training Area No. 2	55	80	54	1.0	63
2	Oil Pit	46	64	76	1.0	62
3	Base Dump	46	60	54	1.0	61
4	Fire Training Area No. 3	48	80	54	1.0	61
5	Fire Training Area No. 1	55	40	69	1.0	55
6	Storm Drainage System	46	40	67	1.0	52
7	Sludge Drying Bed	53	30	54	1.0	46
8	Army Aircraft Burial Site	55	10	54	1.0	40

CHAPTER V

CONCLUSIONS

CHAPTER V

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is the potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on the assessment of the information collected from the project team's field inspection, review of records and files, review of the environmental setting, and interviews with base personnel, past employees and state and local government employees. Table 5.1 contains a list of the potential contamination sources identified at Buckley ANGB and a summary of HARM scores for those sites.

1. Fire Training Area No. 2 has a moderate potential for migration of contaminants. The site was used by the fire department from 1950 until 1972. Hazardous materials including avgas, JP-4, and possibly waste solvents were burned in the area. The site is unlined and within 2,000 feet of the nearest well. FTA No. 2 received a HARM score of 63.

2. The oil pit has a moderate potential for migration of contaminants. The pit contains standing oil and possibly waste solvents. The oil pit is within the East Toll Gate Creek flood plain. The depth to groundwater is estimated to be less than 20 feet. The pit received a HARM score of 62.

3. The base dump has a moderate potential for migration of contaminants. The dump received municipal refuse from Buckley ANGB and Lowry AFB. Paints, solvent containers, pesticide containers, and fuel tank sludges were also deposited in the dump. The site lies within the flood plain of East Toll Gate Creek and is within 500 feet of the installation boundary. The base dump received a HARM score of 61.

4. Fire Training Area No. 3 has a moderate potential for migration of contaminants. The site is used for training exercises by the fire department. Contaminated fuels and possibly waste solvents have been burned in the area. The pit is unlined and is within 1,000 feet of the installation boundary. FTA No. 3 received a HARM score of 61.

5. Fire Training Area No. 1 has a moderate potential for migration of contaminants. The site was used by the fire department during the late 1940's. Contaminated avgas and possibly waste solvents were burned in the area. The pit is unlined and within 500 feet of the nearest surface water. FTA No. 1 received a HARM score of 55.

Table 5.1. Priority Ranking of Potential Contamination Sources at Buckley ANGB.

Rank	Site Name	Date of Operation	Total Overall Score
1	Fire Training Area No. 2	1950 - 1972	63
2	Oil Pit	1950 - 1082	62
3	Base Dump	1942 - 1982	61
4	Fire Training Area No. 3	1972 - 1982	61
5	Fire Training Area No. 1	1946 - 1950	55
6	Storm Drainage System	1942 - 1982	52
7	Sludge Drying Beds	1942 - 1978	46
8	Army Aircraft Burial Site	1942 - 1945	40

6. The storm drainage system adjacent to Building 801 has a moderate potential for contaminant migration. Aircraft cleaning compounds, fuels, de-icers, and possibly solvents have been washed to the drainage system. Contaminants may migrate through sediments leaching into the local surface waters and infiltrating into the groundwater system. The storm drainage system received a HARM score of 52.

7. The sludge drying beds have a low potential for contaminant migration. The beds were in operation from 1942 until 1978. Potentially hazardous materials in the form of heavy metals could have accumulated in the sediments within the drying beds. The drying beds are within 100 feet of the installation boundary. The sludge drying beds received a HARM score of 46.

8. The Army aircraft burial site has a low potential for migration of contaminants. The site may contain small amounts of radioactive materials, incl1ding radium sulfide paint and electron source tubes. The site is within 1,500 feet of the installation boundary. The Army aircraft burial site received a HARM score of 40.

CHAPTER VI

RECOMMENDATIONS

CHAPTER VI

RECOMMENDATIONS

A total of eight sites have been identified as having received hazardous materials at Buckley ANGB. To aid in comparison of these eight sites, the hazardous assessment rating methodology (HARM) was applied. The HARM rating scores indicate the relative need for follow-up work in the Installation Restoration Program. Sites receiving HARM scores between 50 and 65 are considered to have a moderate potential for migration of contaminants, and follow-up Phase II investigations are recommended. Sites receiving HARM scores of less than 50 are considered to have low potential for contaminant migration, and no additional Phase II investigations are recommended. The following recommendations are made to further assess the potential for contaminant migration from hazardous-material receiving areas at Buckley ANGB. The recommended monitoring program is summarized in Table 6.1. Monitoring loctions are given in Figure 6.1.

1. <u>Fire Training Area No. 2</u> is considered to have a moderate potential for migration of contaminants, and monitoring of the site is recommended. The recommended monitoring includes the collection of soil boring samples from three test holes located (1) at the site, (2) 100 feet north, and (3) 100 feet east. The test holes should be 25 feet deep, with samples collected at the surface and at five-foot intervals. If groundwater is encountered, it too should be collected. All samples should be analyzed for the parameters listed in Table 6.2. The bore holes should be used as groundwater monitoring well for continued operation.

2. The <u>oil pit</u> has a moderate potential for migration of contaminants and monitoring is recommended. The contents of the pit should be analyzed. Soil boring samples should be collected from 15-foot deep test holes located 50 feet up-gradient (east) and 50 feet down-gradient (west) of the pit. Soil samples should be collected at the ground surface and at five-foot intervals. All samples should be analyzed for the parameters listed in Table 6.2 as should any groundwater encountered. The bore holes should be used for groundwater monitoring.

3. The <u>base dump</u> has a moderate potential for contaminant migration. Soil boring samples should be collected from test holes located (1) upstream of the site and (2) downstream (at the west boundary of Buckley ANGB). The test holes should be 15 feet deep with samples collected at the ground surface and at five-foot intervals. Any groundwater encountered should also be collected. The bore holes should be used as groundwater monitoring wells for continued monitoring. The samples should be analyzed for the parameters listed in

Table 6.1. Recommended Monitoring Program for Buckley ANGB.

Site	HARM Rating Score	Recommended Monitoring	Rationale
Fire Training Area No. 2	63	Obtain soil borings and sample analysis at three locations. Bore holes are to be used as monitoring wells.	Fuel and possibly solvent burning area used by Fire Department for over 20 years.
Oil Pit	62	Obtain soil borings and sample analysis at two locations. Bore holes are to be used as monitoring wells.	Several feet of standing oil were observed. Oil pit lies in flood plain of East Toll Gate Creek.
Base Dump	61	Obtain soil borings and sample analysis at three locations. Bore holes are to be used as monitoring wells. Conduct water and sediment samples of East Toll Gate Creek.	Site is adjacent to East Toll Gate Creek and contains municipal refuse, fuel tank sludge, paint, and other materials. The site has been used since 1942.
Fire Training Area No. 3	61	Conduct monitoring measures as described for FTA No. 2	Site is used as a burning area. The site is unlined and has been used for 10 years.
Fire Training Area No. 1	55	Conduct monitoring measures as described for FTA No. 2	This unlined site was used as an avgas burning site.
Storm Drainage System (Building 801)	52	Conduct runoff water and sediment sampling program.	Cleaning fluids and fuel spills washed to drainage system.

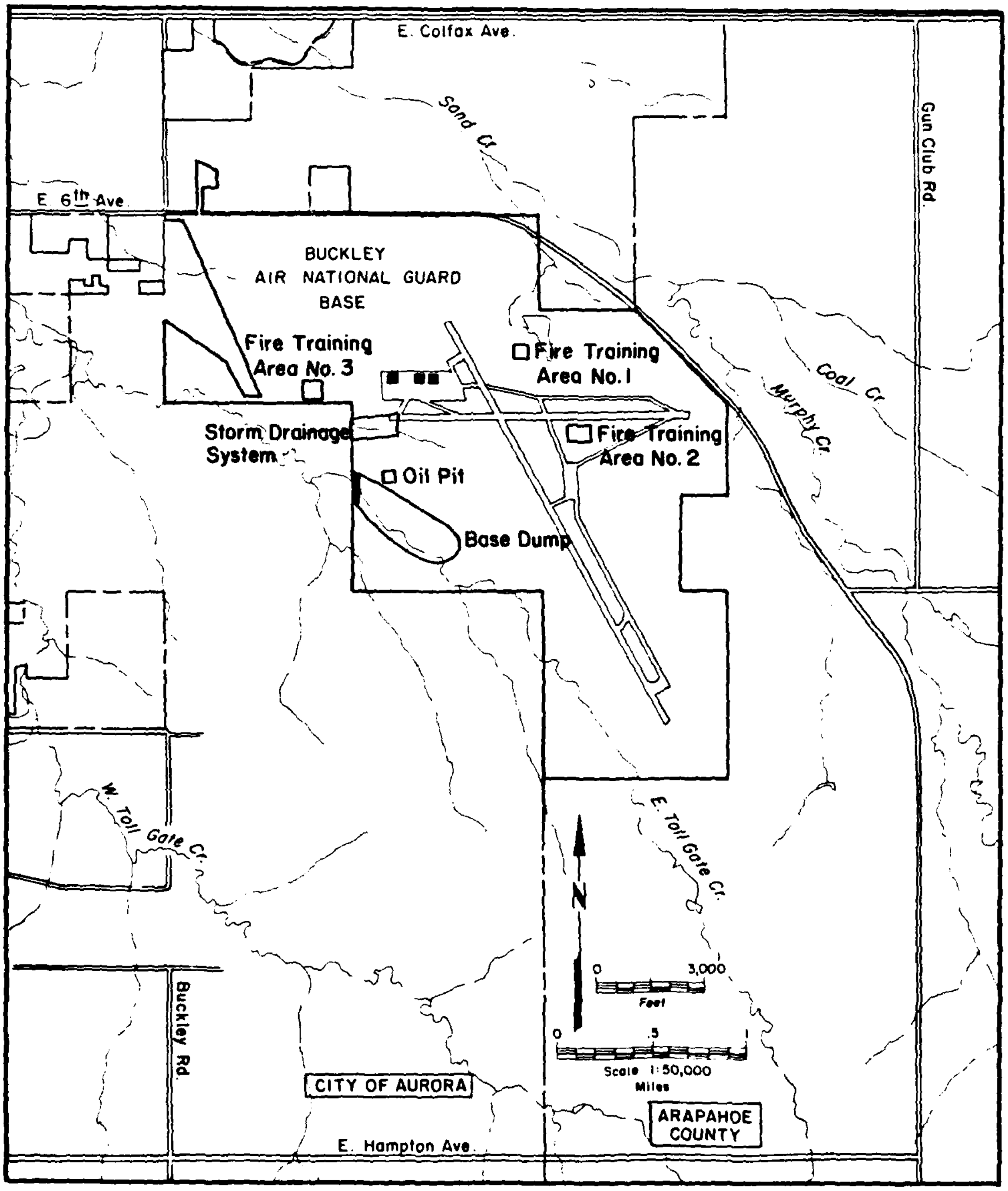


FIGURE 6.1. RECOMMENDED MONITORING LOCATIONS

Table 6.2. Recommended List of Analytical Parameters.

Sample type

Water extract of soil samples
Stream sediment samples
Stream water samples

Analysis to Include

Chemical oxygen demand
Total organic carbon
Oil and grease
Phenol
Lead
Cadium
Chromium
Copper
Zinc
Nickel

Table 6.2. Samples should also be collected from East Toll Gate Creek during periods of storm runoff. The samples should be collected upstream and downstream of the site.

4. Fire Training Area No. 3 has a moderate potential for contaminant migration. The monitoring program should be similar to that proposed for FTA No. 2. The test holes should be located (1) within the area, (2) 100 feet south, and (3) 100 feet west of the area.

5. Fire Training Area No. 1 has a moderate potential for contaminant migration. The monitoring program should be similar to that proposed for FTA No. 2. Test holes should be located within the area and 200 feet northeast (towards the abandoned reservoir). The test holes should be 30 feet deep.

6. The storm drainage system adjacent to Building 801 has a moderate potential for migration of contaminants. Sediment samples should be collected from the drainage ditch at two locations. One sample should be collected adjacent to the apron area and the other collected at the west boundary of the installation. Samples should also be collected from storm water runoff at the installation boundary. Samples should be analyzed for the parameters listed in Table 6.2.

In addition to the recommendations made for Phase II of the IRP, the following recommendations are made.

1. The sludge drying bed at the sewage treatment plant was in use for 36 years and the plant received occasional slugs of industrial-type wastes. It is possible that heavy metals have collected in the soils underlying the bed. The sewage treatment plant is located on a small parcel of land outside the main base boundaries. It is recommended that a soil boring be made to a depth of 15 feet at the northwest corner of the bed. Samples should be collected at five-foot intervals and analyzed for heavy metals, total organic carbon, and oil and grease. If groundwater is encountered, it should be analyzed for the same parameters.

2. The area south of Building 1111 was used for small weapons training and some unexploded ordnance may exist. Signs indicating this possibility should be erected in the area.

APPENDICES

APPENDIX A

BIOGRAPHICAL DATA

Ruh-Ming Li
Executive Vice President and Principal Hydraulic Engineer
Simons, Li & Associates, Inc.

EDUCATION

Cheng Kung University, Taiwan:	B.S. in Hydraulic Engineering,	1965
Colorado State University:	M.S. in Civil Engineering,	1972
Colorado State University:	Ph.D. in Civil Engineering,	1974

TECHNICAL SOCIETIES

American Society of Civil Engineers, Member

American Geophysical Union, Member

HONORS

Walter L. Huber Award for Outstanding Research in Civil Engineering, American Society of Civil Engineers, 1979

Who's Who in Engineering

Who's Who in Technology Today

Who's Who in the West

NATIONAL COMMITTEES

Member, Committee on Erosion and Sedimentation, American Geophysical Union

Member, Task Group on Modeling of Environmental Fate of Chemical Substances, American Society for Testing and Materials

Principal Writer, State-of-the-Art Report on Physics-based Environmental Modeling of Material Release and Waste Disposal for American Society of Civil Engineers

PUBLICATIONS

Over 250 papers and reports in the fields of hydrology, hydraulics, water resources development, and sediment transport.

EXPERIENCE SUMMARY

Dr. Li has more than 15 years of experience in engineering consulting, design and construction supervision and is recognized as a leader in the fields of mathematical modeling of watersheds and river systems. As General

Manager of Simons, Li & Associates, Inc., he is responsible for office administration and technological supervision of all completed and on-going projects. Dr. Li has conducted and/or managed over 200 projects.

Dr. Li's principal fields of expertise are hydraulics, hydrology, watershed management, erosion and sedimentation, mathematical modeling, river mechanics, systems engineering, water resources development, stochastic processes and water quality studies. He has served as a hydraulic consultant for the U.S. Army Corps of Engineers, Alyeska Pipeline Company, Engineering Consultants, Inc., Tipton and Kalmbach, Inc., the U.S. Environmental Protection Agency, USDA Soil Conservation Service, Dames and Moore, Boyle Engineering Corporation and many more nationally and internationally known organizations. In addition to consulting assignments, Dr. Li has participated in and organized many short courses for technology transfer in sediment transport, water resources planning, and analysis of watersheds and rivers.

Prior to forming Simons, Li & Associates, Inc., Dr. Li was an Associate Professor of Civil Engineering at Colorado State University. Before joining Colorado State University, Dr. Li was a civil engineer with Taiwan Power Company. His duties included design and construction supervision of circulating water systems for four thermal power plants. Projects included pump houses, drainage systems, cable conduits, generator foundations, fresh-water wells, water supply systems, including pipeline, booster stations, reservoirs, and bank protection work. In addition, he designed fire protection walls for oil reservoir, bridges, roads, pile foundations, circulating conduits, and a cellular cofferdam breakwater and small docking facility.

Kenneth G. Eggert
Director of Energy Related Projects
Simons, Li & Associates, Inc.

EDUCATION

Purdue University:	B.S. in Aeronautic & Astronautical Engineering, 1969
Colorado University:	M.S. in Civil Engineering, 1976
Colorado State University:	Ph.D. in Civil Engineering, 1980

REGISTRATION

Registered Professional Engineer in: Colorado, No. 17054
Montana, pending

TECHNICAL SOCIETIES

American Society of Civil Engineers, Member

PUBLICATIONS

30 technical papers and reports in the fields of hydrology, hydraulics, and water resources.

EXPERIENCE SUMMARY

Dr. Eggert's interests have been in the development and application of mathematic simulation techniques to problems in hydrologic and hydraulic engineering. He was instrumental in the development of models used to predict surface water and sediment response from watersheds. Applications of these models include prediction of impacts resulting from land use alternatives, calculation of flows in ungaged watersheds, and migration of wastes and pollutants.

His current responsibilities as Director of Energy Related Projects include oversight of permitting studies. These include environmental baseline studies, permit and licensing applications and environmental studies related to the energy and mining industry. His qualifications for these tasks include a knowledge of the state and federal permit process for surface mining, hydropower, hazardous wastes, and of the NEPA process in general. He is also supervising preparation of a short course on the design of water diversions and sediment control in minelands.

Projects Dr. Eggert has supervised or in which he has provided a significant input have included development of a flood forecasting and reservoir optimization model for the Pearl River above Jackson, MS, an erosion and sedimentation study for the Chaco National Historical Park, preparation of a hydrology manual for the Office of Surface Mining and miscellaneous hydrology, hydraulics and sedimentation studies.

Prior to joining Simons, Li & Associates, Inc. in 1980, Dr. Eggert was a Research Associate at Colorado State University, where he was responsible for the development of digital simulations for hydraulic and hydrologic systems, including surface and subsurface flow, alluvial channel hydraulics, sediment detachment transport, and deposition in overland and channel flows. He also supervised and participated in the day-to-day operation of hydraulic model studies in the Colorado State University hydraulics laboratory. His doctoral dissertation provided a comprehensive hydrology simulation for prediction of non-point source pollutant transport. He has lectured on the subject of mechanistic hydrologic calculation of surface water flows for several short courses and has presented papers at numerous national and international technical conferences.

Thomas P. Ballestero
Senior Hydrologist
Simons, Li & Associates, Inc.

EDUCATION

Pennsylvania State University:	B.S. in Civil Engineering, 1975
Pennsylvania State University:	M.S. in Civil Engineering, 1977
Colorado State University:	Ph.D. in Civil Engineering, 1981

REGISTRATION

Professional Engineering registration in Colorado forthcoming.

TECHNICAL SOCIETIES

American Geophysical Union, Member

American Water Resources Association, Member

National Water Well Association, Member

PUBLICATIONS

Fourteen publications on the topics of design of nuclear power plant cooling systems, reservoir operating procedures, water resources planning, flood frequency analysis, hydrogeology, hydrology and statistics.

EXPERIENCE SUMMARY

Dr. Ballestero's work with SLA includes stochastic analysis of daily flows and generation of daily intermittent flows in the Rio Grande watershed, proposals for work and research, a reconnaissance study of low-head hydropower feasibility in the Pacific Northwest, analysis of the hydrology and the scour and deposition periods of the Cowlitz River, environmental assessments, expert witness service, development of statistical programs to analyze hydrologic data, interpretation of water quality analyses, economic analyses of alternatives, and groundwater resources development.

At Colorado State University, Dr. Ballestero majored in hydrology and water resources. He performed research on the modeling of underground pollutant transport and the determination of reservoir operating rules.

While at Colorado State University, Dr. Ballestero became Science Editor for Water Resource Publications. His work there included aid in the interpretation of manuscripts, grammatical review and derivation and corroboration of equations.

During the time of his graduate studies at Penn State, Dr. Ballestero was involved with lecturing for continuing education short courses and undergraduate courses dealing with computer simulation of the watershed system, including HEC-1, HEC-2, flood flow frequency analysis, fluid mechanics, and hydrology, and in consulting work dealing with drought flow analysis, sediment and scour studies, and physical modeling of streams.

Thomas C. Fairley
Environmental Engineer
Simons, Li & Associates, Inc.

EDUCATION

University of Colorado: B.S. in Civil Engineering, 1980

REGISTRATION

Engineer-in-Training, Colorado

EXPERIENCE SUMMARY

Since joining Simons, Li & Associates, Inc. in 1981, Mr. Fairley has completed a variety of projects involving water and sediment runoff analysis, design of hydraulic structures, effects of urban and mined land runoff, and hydraulic and hydrologic modeling.

Prior to joining Simons, Li & Associates, Inc., Mr. Fairley worked for Camp Dresser & McKee, Inc. While with Camp Dresser & McKee, Inc., Mr. Fairley was involved in an industrial waste survey, sludge drying bed study, and design of improvements to the industrial waste collection, pumping, and treatment system at Stapleton International Airport in Denver, Colorado. Mr. Fairley also prepared a report discussing the effects of Stapleton's waste on Sand Creek and designed improvments to the industrial waste collection system at Frontier Airlines' facilities at Stapleton International Airport.

Other projects included preparation of federal flood insurance studies for nine Colorado communities, construction management for the City and County of Denver during construction of $6 million in improvements to the wastewater collection system, and supervision of a comprehensive monitoring program for the Omaha, Nebraska combined sewer system.

Walter W. Melvin, Jr.
Environmental Health Specialist
Simons, Li & Associates, Inc.

EDUCATION

University of Colorado School of Medicine	M.D., General, 1949
Harvard School of Public Health, Boston, Mass.	M.S., Public Health, 1953
University of Cincinnati, Cincinnati, Ohio	Dr. of Science, Environmental Toxicology/Occupation Health, 1962

PUBLICATIONS

Over 40 publications on toxicology and environmental health.

EXPERIENCE SUMMARY

Dr. Melvin specializes in the study of hazardous waste and waste disposal, and their toxic effect. Over the past 30 years, Dr. Melvin has taught environmental health and toxicology on both the undergraduate and graduate levels. While in the U.S. Air Force, his military tour assignment included environmental pollution evaluation, abatement and control, biometrics, and a seven-year assignment as Chief Scientist to study effects of the disposal of Herbicide Orange. Dr. Melvin is currently a Professor at the Institute of Rural Environmental Health at Colorado State University.

APPENDIX B

OUTSIDE AGENCY CONTACT LIST

1. United States Department of Commerce, National Weather Service, Denver, Colorado, (303)398-3964.

2. United States Department of the Interior, Geological Survey, Denver, Colorado; Mr. S. G. Robson, (303) 837-4169.

3. United States Department of Agriculture, Soil Conservation Service, Lakewood, Colorado; Mr. Roy Bell, (303) 837-5688.

4. United States Environmental Protection Agency, Region VIII, Denver, Colorado; Mr. Bob Burm, (303) 837-4901.

5. United States Fish and Wildlife Service, Western Regional Office, Salt Lake City, Utah; Mr. Fred Bolwahnn, (801) 524-4430.

6. Colorado Geological Survey, Denver, Colorado, (303) 866-2611.

7. Colorado State Engineer, Water Well Records, Denver, Colorado, (303) 866-3581.

8. Colorado Division of Water Resources, Denver, Colorado; Mr. John Romero, (303) 866-3587.

9. Colorado Water Conservation Board, Denver, Colorado, (303) 866-3441.

10. Colorado Division of Wildlife, Denver, Colorado, (303) 825-1192.

11. Colorado Department of Health, Denver, Colorado; Mr. Dennis Sanderson and Mr. Curtis Sutton, (303) 320-8333.

12. Urban Drainage and Flood Control District, Denver, Colorado; Mr. Ben Urbonas, (303) 455-6277.

13. Plains Conservation Center, Arapahoe County, Colorado.

14. City of Aurora, Wastewater Division, Mr. Bob Genty (303) 695-7519.

APPENDIX C

HISTORY OF BUCKLEY AIR NATIONAL GUARD BASE

APPENDIX C

HISTORY OF BUCKLEY ANGB

I. HISTORY

The increasing involvement of the United States in the European War in 1941 resulted in plans to enlarge Lowry Army Air Field. The site for Buckley ANG Base was purchased by the City and County of Denver and donated to the Department of the Army in early 1942. The site was named Buckley Field in honor of Lt. John Harold Buckley, a World War I flying hero from Colorado who died in action in 1918.

A contract for architectural and engineering services was awarded in April 1942, and construction began in May 1942. The Army Air Corps Technical School, Buckley Field, was opened July 1, 1942, with Brigadier General L. A. Lawson commanding. Physical facilities included streets, runways, over 700 structures, 10 water wells, a water distribution system, a sewage collection and treatment system, an electric distribution system, a communications system, 16,800 feet of railroad track and a coal-fired steam heating system.

Training was offered in B-17 and B-24 aircraft armaments. The increasing need for military personnel required additional basic training sites, and in 1943, three basic training camps were opened at the Lowry Bombing Range under Buckley command. The Arctic Training Command was transferred to Buckley Field in 1943 and a separate training facility was opened at Echo Lake, Colorado. The period from January through June of 1943 saw 30,000 personnel receive armament training, 10,000 personnel receive basic training, and 2,000 receive Arctic training. As the Army Air Corps approached full strength in 1944, additional training requirements diminished. Buckley Field saw a gradual decline in personnel in 1944 and 1945 and was designated as a sub-base of Lowry in 1946. Operation of Buckley was transferred to the Colorado Air National Guard in 1946 as a training site. In 1947, the Department of the Navy assumed command and renamed the facility Naval Air Station - Denver, Colorado. The Navy operated the facility as a training base and transient air station. The U.S. Navy deactivated the station at Buckley in May 1959, and ownership was licensed to the State of Colorado. The installation was then named Buckley Air National Guard Base, and the ANG has operated the base since then.

2. MISSION

Buckley ANGB has three distinct missions. It provides the site for training to combat-readiness of tactical units of the Colorado Air National Guard. It is the only military airbase in the Denver metropolitan area, supporting aircraft of all commands and services around the clock, and it provides support for numerous Department of Defense tenant activities assigned to the Base. As the only military flying base in the area, Buckley is also charged with certain responsibilities related to aircraft search and crash response within the geographical area. In addition to supporting over 60 base-assigned aircraft, the Base also supports up to 10,000 transient military aircraft per year.

3. ORGANIZATIONAL LISTING

Assigned Units/Activities include:

COLORADO AIR NATIONAL GUARD:

- Detachment 1, Headquarters, Colorado ANG (Host)
- 140th Tactical Fighter Wing and Assigned Units
- 154th Tactical Control Group

TENANTS:

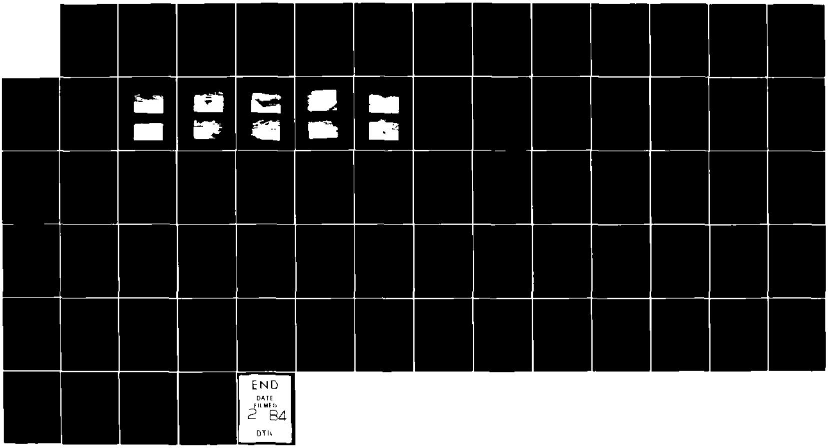
- Det 3, SAMSO (Aerospace Data Facility) (AFSC)
- 2nd Comm Sq (Aerospace Data Facility) (SAC)
- Det 3, 375th Aeromedical Airlift Wing (MAC)
- Det 29, 15th Weather Squadron (MAC)
- 1987th Communications Squadron (FF) (AFCS)
- Marine Air Reserve Training Unit
- Naval Air Reserve Training Detachment
- Colorado Army National Guard
  - 19th Special Forces Group (AB)
  - 147th Medical Hospital
  - 1157th Aviation Company (Attack Helicopter)
  - Army Aviation Support Facility
- ANG/CCTV - Multi-Media Production Center
- Lowry AFB Aero Club
- Civil Air Patrol

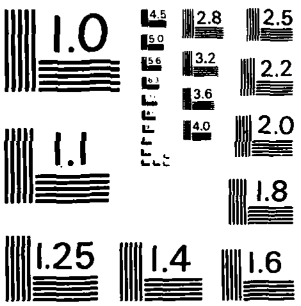
APPENDIX D

SUPPLEMENTAL ENVIRONMENTAL SETTING INFORMATION

AD A136 995 INSTALLATION RESTORATION PROGRAM PHASE I RECORDS SEARCH 2/2
BUCKLEY AIR NATIO..(U) SIMONS LI AND ASSOCIATES INC
FORT COLLINS CO SEP 82 DAHA05-82-C-0006

UNCLASSIFIED F/G 13/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX D

SUPPLEMENTAL ENVIRONMENTAL

SETTING INFORMATION

Buckley ANG Base is situated in the high plains of eastern Colorado. The fauna and flora of the area are typical of semiarid prairie regions. Buckley is bounded on the west and north by the City of Aurora, on the south by the Plains Conservation Center, and on the east by agricultural land. Studies were conducted in 1975 by the Soil Conservation Service and the Colorado Division of Wildlife as part of the Environmental Impact Statement for the Aurora Tollgate Village Development. These studies found no rare or endangered species of plants or animal life. The types of vegetation found at the Plains Conservation Center (located on the southern boundary of Buckley) are identified in Table D-1. Wildlife found in the area are identified in Table D-2. This table lists all species that have been sighted in the last 15 years.

Buckley ANGB is located in the historical range of the black-footed ferret, Mustela nigripes, but no sightings have been made at Buckley of this endangered species and no sightings have been made in the state of Colorado in the past 15 years. Golden and bald eagles occasionally migrate through the Buckley region, but do not nest in the area.

Table D.1. Principal Vegetation Found at the Plains Conservation Center.

Native	
Lambs Quarter Goosefoot	Curly Cup Gumweed
Little Bluestem	Fringed Sagebrush
Needle and Thread	Goldenrod
Pigweed	Hairy Grama
Prairie Pepperweed	Indian Rice Grass
Prickle Poppy	Wooly Indian Wheat
Rabbit Brush	June Grass
Red Three Awn	Silky Sophora
Ring Muhly	Sankeweed
Rose Thistle	Yucca
Rush Skeleton Plant	Tumblegrass
Pasture Sage	Western Wheat Grass
Sand Dropseed	Wild Licorice
Scarlet Glowmallow	Wild Lettuce
Scarlet Gaura	Winter Fat
Big Bluestem	Green Needlegrass
Blazing Star	Drummonds Wildvetch
Blue Grama	Small Flower Psoralea
Buffalo Grass	Plains Prickly Pear
Plains Cottonwood	Prairie Sandreed
Peach Leaf Willow	Sedges Bush Buckwheat
Common Sunflower	Hairy Goldaster
Cone Flower	Prairie Clover
Squirrel Tail	Canada Ryegrass
Switch Grass	Wormwood
Lamberts Loco	Sanbergs Bluegrass
Cheat Grass	Six-Week Fescue
Non-Native	
Kentucky Bluegrass	Japanese Chess
Russian Thistle	Yellow Sweet Clover
Common Dandelion	Crested Wheatgrass

Source: T. Eaman, SCS, August 1975.

Table D.2a. Mammals Found in the Buckley ANG Base Region.

Masked Shrew
Sorex cinereus

Least Shrew
Cryptotis parva

Eastern Cottontail
Sylvilagus floridanus

Desert Cottontail
Sylvilagus audubonii

White-tailed Jackrabbit
Lepus townsendii

Black-tailed Jackrabbit
Lepus californicus

Least Chipmunk
Eutamias minimus

Thirteen-lined Ground Squirrel
Spermophilus tridecemlineatus

Spotted Ground Squirrel
Spermophilus spilosoma

Rock Squirrel
Spermophilus variegatus

Black-tailed Prairie Dog
Cynomys iudouicianus

Fox Squirrel
Sciurus niger

Northern Pocket Gopher
Thomomys talpoides

Plains Pocket Gopher
Geomys bursarius

Olive-backed Pocket Mouse
Perognathus fasciatus

Plains Pocket Mouse
Perognathus flauescens

Silky Pocket Mouse
Perognathus flavus

Hispid Pocket Mouse
Perognathus hispidus

Ord's Kangaroo Rat
Dipodomys ordii

Beaver
Castor canadensis

Plains Harvest Mouse
Reithrodontomys montanus

Western Harvest Mouse
Reithrodontomys megalotis

Deer Mouse
Deromyscus maniculatus

Northern Grasshopper Mouse
Onochomys leucogaster

Meadow Vole
Microtus pennsylvanicus

Prairie Vole
Microtus ochrogaster

Muskrat
Ondatra zibethicus

Meadow Jumping Mouse
Zapus hudsonius

Porcupine
Erethizon dorsatum

Coyote
Canis latrans

Red Fox
Vulpes vulpes

Swift Fox
Vulpes velox

Table D.2a continued.

Gray Fox Vrocyon cinereoargenteus	Bobcat Lynx rufus
Raccoon Procyon lotor	White-tailed Deer Ooocolleus virginianus
Long-tailed Weasel Mustela frenata	Pronghorn Antelope Antilocapra americana
Badger Taxidea taxus	House Mouse Mus musculus
Striped Skunk Mephitis mephitis	Norway Rat Rattus norvegicus

Table D.2b. Marsupials Found in the Buckley ANG Base Region.

Opposum *Didelphis marsupialis*

Table D.2c. Reptiles and Amphibians Found in the Buckley ANG Base Region.

Tiger Salamander *Ambystoma tigrinum*	Prairie Race Runner *Cnemidophorus sexlineatus viridis*
Great Plains Toad *Bufo cognatus*	Northern Many-lined Skink *Eumeces multivirgatus multivirgatus*
Woodhouse's Toad *Bufo woodhousei woodhousei*	Eastern Yellowbelly Racer *Coluber constrictor flaviventris*
Boreal Chorus Frog *Pseudacris triseriata maculata*	Plains Hognose Snake *Heterodon nasicus nasicus*
Bullfrog *Rana catesbiana*	Milk Snake *Lampropeltis triangulum*
Northern Leopard Frog *Rana pipiens*	Western Coachwhip *Masticophis flagellum testaceus*
Plains Spadefoot *Scaphiopus bombifrons*	Northern Water Snake *Nerodia sipedon sipedon*
Common Snapping Turtle *Chelydra serpentina serpentina*	Western Smooth Green Snake *Opheodrys vernalis blanchardi*
Western Painted Turtle *Chrysemys picta belli*	Bullsnake *Pituophis melanoleucus sayi*
Ornate Box Turtle *Terrapene ornata ornata*	Wandering Garter Snake *Thamnophis elegans vagrans*
Western Spiney Softshell *Trionyx spiniferus hartwegi*	Western Plains Garter Snake *Thamnophis radix haydeni*
Northern Earless Lizard *Holbrookia maculata maculata*	Red-sided Garter Snake *Thamnophis sirtalis parietalis*
Short-horned Lizard *Phrynosoma douglassi*	Northern Lined Snake *Tropidoclonion lineatun lineatum*
Red-lipped Prairie Lizard *Sceloporus undulatus erythrocheilus*	Prairie Rattlesnake *Crotalus viridis viridis*
Northern Prairie Lizard *Sceloporus undulatus garmani*	

Table D.2d. Birds Found in the Buckley ANG Base Region (including residents, migrants and stragglers).

Common Loon	White-winged Scoter
Arctic Loon	Surf Scoter
Red-necked Grebe	Black Scoter
Horned Grebe	Ruddy Duck
Eared Grebe	Hooded Merganser
Western Grebe	Common Merganser
Pie-billed Grebe	Red-Breasted Merganser
White Pelican	Turkey Vulture
Double-crested Cormorant	Goshawk
Great Blue Heron	Sharp-shinned Hawk
Northern Green Heron	Cooper's Hawk
Little Blue Heron	Red-tailed Hawk
Cattle Egret	Red-shouldered Hawk
Great Egret	Broad-winged Hawk
Snowy Egret	Swainson's Hawk
Louisiana Heron	Rough-legged Hawk
Black-crowned Night Heron	Ferruginous Hawk
Yellow-crowned Night Heron	Golden Eagle
American Bittern	Bald Eagle
White-faced Ibis	Marsh Hawk
Whistling Swan	Osprey
Canada Goose	Gyr Falcon
Brant	Prairie Falcon
White-fronted Goose	Peregrine Falcon
Snow Goose	Merlin
Ross' Goose	American Kestrel
Mallard	Sharp-tailed Grouse
Black Duck	Bobwhite
Gadwall	Ring-necked Pheasant
Pintail	Chukar
American Green-winged Teal	Turkey
Blue-winged Teal	Sandhill Crane
Cinnamon Teal	Virginia Rail
European Wigeon	Sora
Northern Shoveler	American Coot
Wood Duck	Semipalmated Plover
Redhead	Piping Plover
Ring-necked Duck	Snowy Plover
Canvasback	Killdeer
Greater Scaup	Mountain Plover
Lesser Scaup	American Golden Plover
Common Goldeneye	Black-bellied Plover
Barrow's Goldeneye	Ruddy Turnstone
Bufflehead	Common Snipe
Oldsquaw	Long-billed Curlew
Harlequin Duck	Whimbrel

Table D.2d continued.

Upland Sandpiper	Snowy Owl
Spotted Sandpiper	Pygmy Owl
Solitary Sandpiper	Burrowing Owl
Willit	Spotted Owl
Greater Yellowlegs	Long-eared Owl
Lesser Yellowlegs	Short-eared Owl
Red Knot	Saw-whet Owl
Pectoral Sandpiper	Poor-will
White-rumped Sandpiper	Common Nighthawk
Baird's Sandpiper	Chimney Swift
Least Sandpiper	White-throated Swift
Dunlin	Broad-tailed Hummingbird
Short-billed Dowitcher	Autous Hummingbird
Stilt Sandpiper	Belted Kingfisher
Semipalmated Sandpiper	Common Flicker
Western Sandpiper	Red-bellied Woodpecker
Buff-breasted Sandpiper	Red-headed Woodpecker
Marbled Godwit	Lewis' Woodpecker
Hudsonian Godwit	Yellow-bellied Sapsucker
Sanderling	Williamson's Sapsucker
American Avocet	Hairy Woodpecker
Black-necked Stilt	Downy Woodpecker
Red Phalarope	Eastern Kingbird
Wilson's Phalarope	Western Kingbird
Northern Phalarope	Cassin's Kingbird
Pomarine Jaeger	Scissor-tailed Flycatcher
Parasitic Jaeger	Great Creasted Flycatcher
Glaucous Gull	Ash-throated Flycatcher
Herring Gull	Eastern Phoebe
Thayer's Gull	Say's Phoebe
California Gull	Willow Flycatcher
Ring-billed Gull	Least Flycatcher
Laughing Gull	Hammond's Flycatcher
Franklin's Gull	Dusky Flycatcher
Bonaparte's Gull	Western Flycatcher
Black-legged Kittiwake	Western Wood Pewee
Sabine's Gull	Olive-sided Flycatcher
Foster's Tern	Vermilion Flycatcher
Common Tern	Horned Lark
Black Tern	Violet-green Swallow
Band-tailed Pigeon	Tree Swallow
Rock Dove	Bank Swallow
Mourning Dove	Rough-winged Swallow
Yellow-billed Cuckoo	Barn Swallow
Black-billed Cuckoo	Cliff Swallow
Barn Owl	Purple Martin
Screech Owl	Blue Jay
Flammulated Owl	Steller's Jay
Great Horned Owl	Scrub Jay

Table D.2d continued.

Black-billed Magpie	Red-eyed Vireo
Common Raven	Philadelphia Vireo
White-necked Raven	Warbling Vireo
Common Crow	Black-and-white Warbler
Pinyon Jay	Worm-eating Warbler
Clark's Nutcracker	Golden-winged Warbler
Black-capped Chickadee	Blue-winged Warbler
Mountain Chickadee	Tennessee Warbler
White-breasted Nuthatch	Orange-crowned Warbler
Red-breasted Nuthatch	Nashville Warbler
Pygmy Nuthatch	Virginia's Warbler
Brown Creeper	Northern Parula
Dipper	Yellow Warbler
House Wren	Magnolia Warbler
Winter Wren	Black-throated Blue Warbler
Bewick's Wren	Yellow-rumped Warbler
Carolina Wren	Black-throated Gray Warbler
Long-billed Marsh Wren	Townsend's Warbler
Canyon Wren	Black-throated Green Warbler
Rock Wren	Blackburnian Warbler
Mockingbird	Yellow-throated Warbler
Gray Catbird	Chestnut-sided Warbler
Trown Thrasher	Bay-breasted Warbler
Sage Thrasher	Blackpoll Warbler
American Robin	Palm Warbler
Varied Thrush	Ovenbird
Wood Thrush	Northern Waterthrush
Hermit Thrush	MacGillivray's Warbler
Swainson's Thrush	Common Yellowthroat
Gray-cheeked Thrush	Yellow-breasted Chat
Veery	Hooded Warbler
Eastern Bluebird	Wilson's Warbler
Western Bluebird	Canada Warbler
Mountain Bluebird	American Redstart
Townsend's Solitaire	House Sparrow
Blue-gray Gnatcather	Bobolink
Golden-crowned Kinglet	Western Meadowlark
Ruby-crowned Kinglet	Yellow-headed Blackbird
Water Pipit	Red-winged Blackbird
Sprague's Pipit	Orchard Oriole
Bohemian Waxwing	Northern Oriole
Cedar Waxwing	Rusty Blackbird
Northern Shrike	Brewer's Blackbird
Loggerhead Shrike	Common Grackle
Starling	Brown-headed Cowbird
Bell's Vireo	Western Tanager
Yellow-throated Vireo	Scarlet Tanager
Solitary Vireo	

Table D.2d continued.

Summer Tanager	Savannah Sparrow
Cardinal	Baird's Sparrow
Rose-breasted Grosbeak	Vesper Sparrow
Black-headed Grosbeak	Lark Sparrow
Blue Grosbeak	Cassin's Sparrow
Indigo Bunting	Black-throated Sparrow
Lazuli Bunting	Sage Sparrow
Painted Bunting	Dark-eyed Junco
Dickcissel	Gray-headed Junco
Evening Grosbeak	Tree Sparrow
Purple Finch	Chipping Sparrow
Cassin's Finch	Clay-colored Sparrow
House Finch	Brewer's Sparrow
Pine Grosbeak	Field Sparrow
Gray-crowned Rosy Finch	Harvis' Sparrow
Black Rosy Finch	White-crowned Sparrow
Brown-capped Rosy Finch	White-throated Sparrow
Common Redpoll	Fox Sparrow
Pine Siskin	Lincoln's Sparrow
American Goldfinch	Swamp Sparrow
Lesser Goldfinch	Song Sparrow
Red Crossbill	McCown's Longspur
White-winged Crossbill	Lapland Longspur
Green-tailed Towhee	Chestnut-collared Longspur
Rufous-sided Towhee	Snow Bunting
Lark Bunting	

APPENDIX E

SHOP LISTING

Master List of Shops

Name	Building Number	Waste Generator
Aerospace Ground Equipment	814	*
Aircraft Maintenance Docks	801	*
Avionics	950	
Corrosion Control/Fuel Cell Repair	800	*
Electrical/Environmental Shop	801	*
Flight Simulator	850	
Jet Engine Shop	960	
Machine Shop	801	
Munitions Storage	924	
NDI/SOAP Laboratory	801	*
Parachute/Life Support Shop	801	
Pneudraulic/Hydraulic Shop	801	
Reclamation/Tire Shop	801	*
Structural Repair	801	
Weapons Shop	950	
Welding Shop	801	
War Readiness Supply Kit	504	
Motor Pool	940	*
Refueling Maintenance	710	
Base Hospital	33	
154th Tactical Control Group	25	
Base Photo Laboratory	801	*
Transient Maintenance	[illegible]	
Base Supply	841	
POL/Fuels Laboratory	300	*
Shipping/Transportation	841	
Civil Engineering Carpenter Shop	711	
Civil Engineering Electric Shop	711	
Civil Engineering Equipment Shop	711	
Civil Engineering Heating Plant	903	

Master List of Shops (continued)

Name	Building Number	Waste Generator
Civil Engineering Paint/Print Shop	711	
Civil Engineering Plumbing Shop	711	
Civil Engineering Roads and Grounds	719	
Civil Engineering Sheet Metal Shop	711	
Civil Engineering Water Treatment	906	
1987 Comm. Sqd/GCA Facility	909	
DET 29, 25 Weather Squadron	909	
Army Aviation Support Facility	1500	*
Marine Air Control Station (MACS23)	543	*
2 Comm. Squadron	429	
Aerospace Data Facility	401	

APPENDIX F

PHOTOGRAPHS

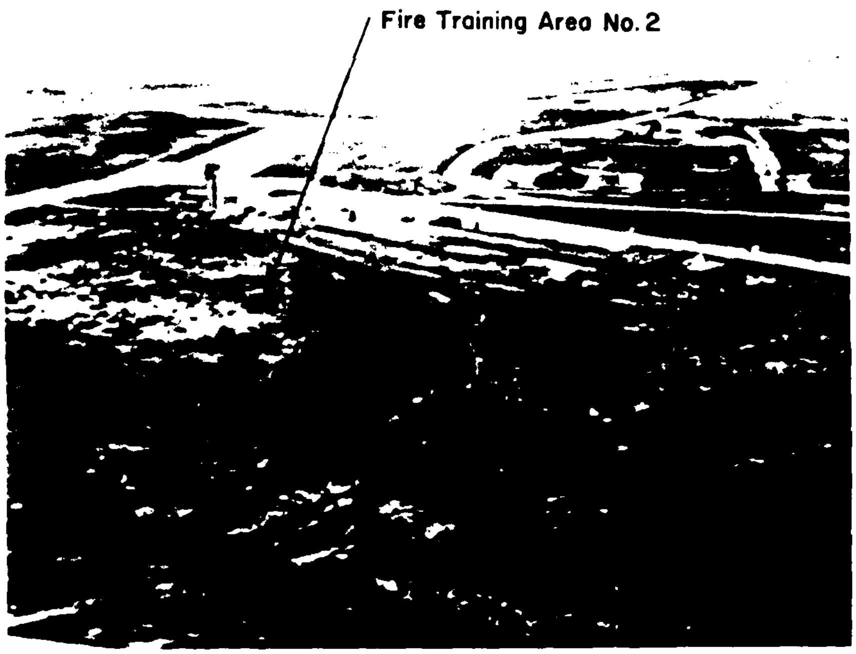


FIGURE F.1. FIRE TRAINING AREA NO. 2

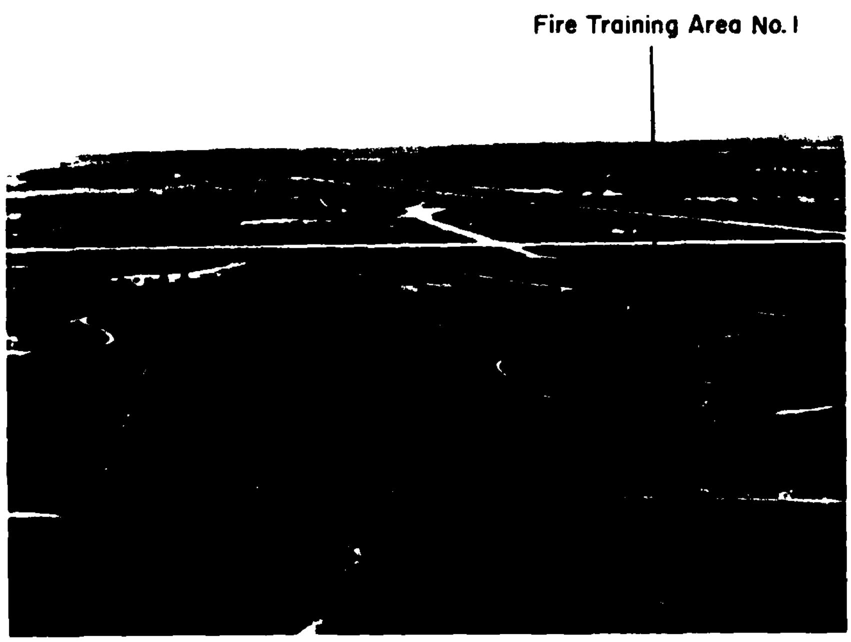


FIGURE F.2. FIRE TRAINING AREA NO. 1

FIGURE F.3. FIRE TRAINING AREA NO. 3

FIGURE F.4. FIRE TRAINING AREA NO. 3

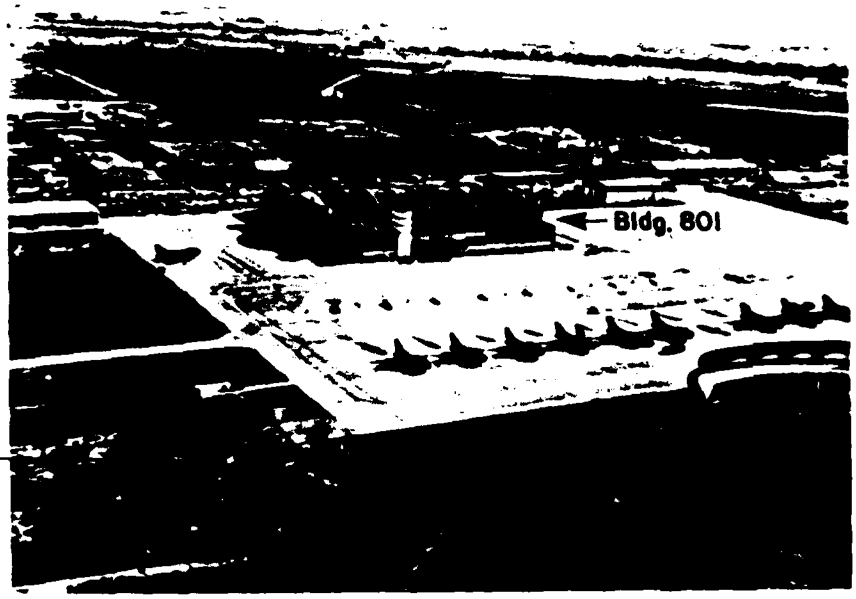


FIGURE F.5. STORM DRAINAGE SYSTEM

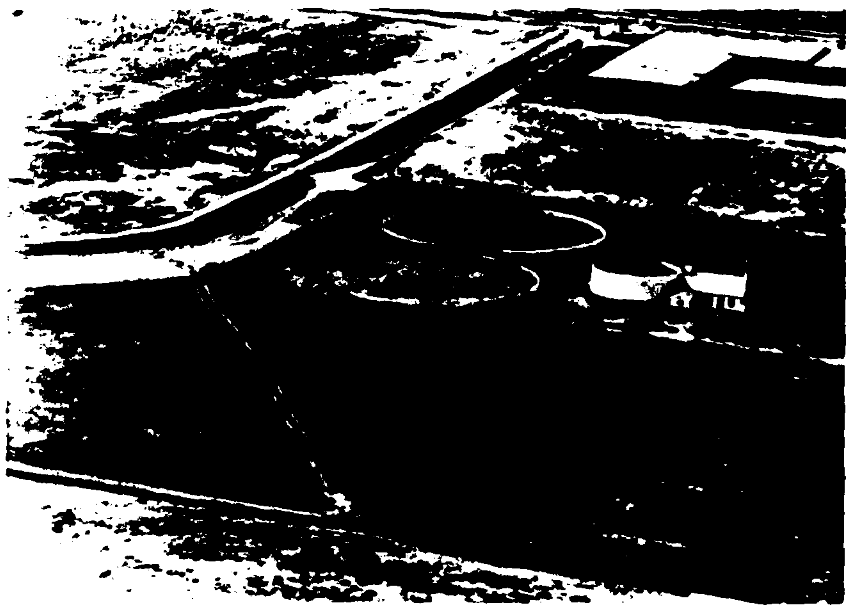


FIGURE F.6. SEWAGE TREATMENT PLANT

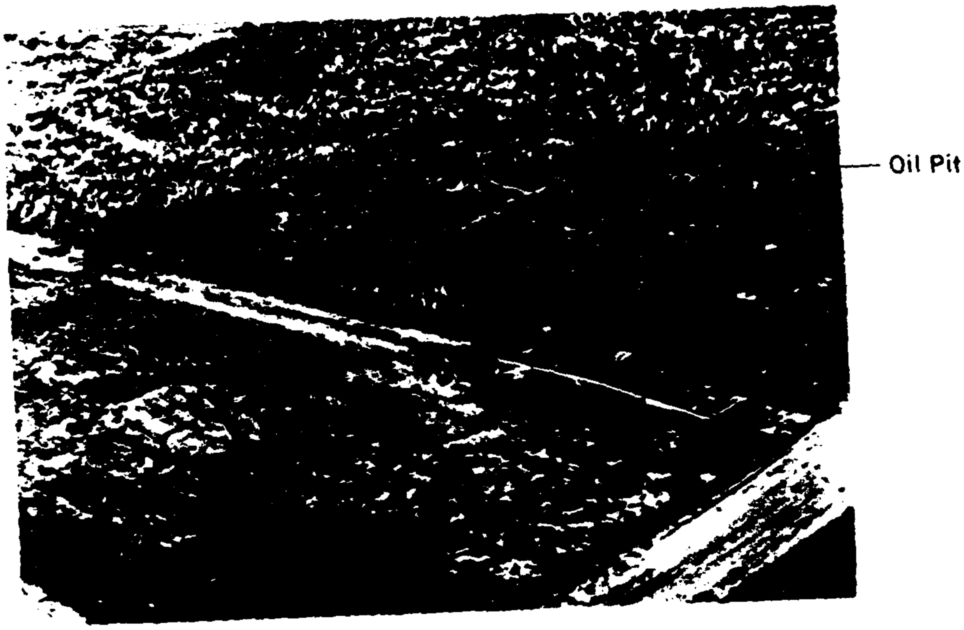


FIGURE F.7. OIL PIT

FIGURE F.8. OIL PIT

F.9. BASE DUMP

FIGURE F.10. BASE DUMP

APPENDIX G

STORAGE AND DISPOSAL OF DDT AND RESULTS OF PCB ANALYSIS

APPENDIX G

STORAGE ANΓ DISPOSAL OF DDT

Several thousand pounds of DDT were stored at Buckley ANGB for a short period of time. The disposal of the DDT was handled by a private contractor (Chemical Waste Management)through DPDO. Following disposal, the storage area was cleared of any residual material by the contractor. The attached correspondance documents the Air National Guard involvement.

Also included in this appendix are the laboratory analyses of electric transformers.

DEPARTMENT OF MILITARY AFFAIRS
OPERATING LOCATION AA (COANG)
BUCKLEY AIR NATIONAL GUARD BASE, AURORA, COLORADO 80011

REPLY TO
ATTN OF: OL-AA/CC

29 October 1981

SUBJECT: Storage of DDT

TO: EPA Air and Hazardous Materials Division(Mr Lawrence Wapenski)
1860 Lincoln St
Denver, Colorado 80295

In response to a telephone conversation on 28 October 1981 between Mr Wapenski and CMSgt Jones concerning DDT Storage at Buckley ANG Base; the DDT is to be disposed of by nationwide contract issued thru the Defense Logistics Agency for all Department of Defense Installations. The contract solicitation number is DLA-003-81-R-0030 and has been awarded to Chemical Waste Managment Corporation. The contract final completion date is not later than 30 December 1981. The available pickup schedule at this time is thru 6 November and includes Cheyenne, WY but not Buckley. It is anticipated Buckley could be in the following phase schedule. The contract requires handling, transportation, cleanup of the storage facility and disposal in strict accordance with Federal Regulations. Final disposal is to be by incineration.

Prior to receiving the above information and after our requested visit from your office, by Mr's Rasch, Shosky, and Miullo, we had prepared Part A forms 1 and 2 and prepared a Hazardous Waste Management Plan in accordance with 40CFR Part 265 for submittal to your offfice for issuance of an Interim Storage Permit.

We greatly appreciate the assistance of you and your staff concerning this matter and will continue to monitor the storage area until removed by the contractor. We will notify you immediately upon its removal. Any further requirements on this matter please contact CMSgt Jones, 340-9909.

STANLEY C. WOOD, Col, COANG
Base Commander

DEPARTMENT OF MILITARY AFFAIRS

OPERATING LOCATION AA (COANG)
BUCKLEY AIR NATIONAL GUARD BASE AURORA COLORADO 80011

REPLY TO ATTN OF: OL-AA/CC

18 November 1981

SUBJECT: Storage of DDT

TO: EPA Air and Hazardous Materials Division (Mr Lawrence Wapenski)
1860 Lincoln St
Denver, Colorado 80295

As a follow up to our letter to you on 29 October 1981 concerning DDT Storage at Buckley ANG Base on 17 November 1981 all DDT stored at this installation was removed. This material was picked up by Chemical Waste Management Corporation under a contract issued by the Defense Logistics Agency. The storage area was properly cleaned and all contaminated materials removed by the contractor. All removed material is to be properly disposed of in accordance with Federal Regulation. We are told by DLA it will be several weeks before we have a manifest.

Thank you for your cooperation and assistance in this matter and hopefully we can consider it closed.

Stanley C. Wood

STANLEY C. WOOD, Col, COANG
Base Commander

DEPARTMENT OF MILITARY AFFAIRS

OPERATING LOCATION AA (COANG)
BUCKLEY AIR NATIONAL GUARD BASE, AURORA, COLORADO 80011

140 TAC HOSPITAL/SCP 2 July 81

Analysis of Transformer Oil Samples

USAF OEHL/SA
Brooks AFB, TX 78235

Request that your laboratory analyze the enclosed transformer oil samples in the most expedient manner possible. These samples were taken from transformers being shipped off-base to a factory in South Dakota for rebuilding. The company refuses to accept PCB contaminated equipment. The electrical contractor working at Buckley ANG Base has a contractual obligation to dispose of the transformers in a proper manner and this is based on PCB concentration. The attached listing includes the serial numbers of the transformers and this number is used to identify the sample. Thank you for your attention to this request.

Michael P. Rowan

MICHAEL P. ROWAN, GS-7
Environmental Health Technician

LIST OF USED TRANSFORMERS

POLE MOUNT TRANSFORMERS		MAKE	SERIAL NUMBER
1.	50 KVA	GE 120/240	K497534K72AA
2.	50 KVA	GE 12/240	K497536K72AA
3.	25 KVA	Harrison Trans Co 120/240	7084
4.	37½ KVA	McGraw Edison 120/240	70VF614006
5.	37½ KVA	McGraw Edison 120/240	70VF614007
6.	37½ KVA	McGraw Edison 120/240	70VF614005
7.	15 KVA	Line Matfrial 12-.240	286183
8.	5 KVA	GE 120/240	D468230-60P
9.	25 KVA	Line Material 120/240	285983
10.	50 KVA	Kulhman 277	4630861002
11.	50 KVA	Kulhman 277	4630861001
12.	50 KVA	Kulhman 277	4630861003
13.	25 KVA	Line Material 120/240	284647
14.	15 KVA	Line Material 120/240	F2350604
15.	37½ KVA	GE 120/240	E10834-60Y
16.	37½ KVA	GE 277/480Y	M538794YFPA
17.	37½ KVA	GE 277/480Y	M538799YFPA
18.	37½ KVA	GE 277/480Y	M538797YFPA
19.	37½ KVA	GE 277/480Y	M538798YFPA
20.	37½ KVA	GE 277/480Y	M538796YFPA
21.	37½ KVA	GE 270/480Y	M585968YFPA
22.	15 KVA	ESCO 120/240	7128227
23.	25 KVA	RTE 120/240	7220319
24.	25 KVA	RTE 120/240	7220318
25.	25 KVA	Line Material 120/240	284638
26.	50 KVA	Allis Chalmers 120/240	1809977
27.	50 KVA	Allis Chalmers 120/240	1809991
28.	50 KVA	Line Material 120/240	288515
29.	25 KVA	Line Material 120/240	284657
30.	37½ KVA	Line Material 120/240	G41J4209
31.	37½ KVA	Line Materials 120/240	G26K9906
32.	37½ KVA	Line Materials 120/240	G3726802
33.	75 KVA	Line Materials 120/240	285794
34.	75 KVA	Line Materials 120/240	287601
35.	75 KVA	Line Materials 120/240	287599
36.	50 KVA	Allis Chalmers 120/240	5369662
37.	50 KVA	Trans. Unlimited 120/240	73J2265
38.	50 KVA	Allis Chalmers 120/240	5369667
39.	100 KVA	Trans Unlimited 240/480	B469394
40.	100 KVA	Trans Unlimited 240/480	B469392
41.	100 KVA	Trans Unlimited 240/480	B469393
42.	75 KVA	Moloney 120/240	1751963-1
43	75 KVA	Moloney 120/240	1751963-2
44.	75 KVA	Moloney 120/240	1751963-3
45.	200 KVA	Allis Chalmers 120/240	1816045
46.	200 KVA	Allis Chalmers 120/240	1816046

LIST OF USED TRANSFORMERS (Con't)

POLE MOUNT TRANSFORMERS		MAKE	SERIAL NUMBER
47.	200 KVA	Allis Chalmers 120/240	1816043
48.	37.5 KVA	Line Material 120/240	284225
49.	37.5 KVA	Line Material 120/240	285881
50.	37.5 KVA	Allis Chalmers 120/240	1812302
51.	15 KVA	Line Material 12-.240	286204
52.	50 KVA	Allis Chalmers 120/240	5369665
53.	15 KVA	Line Material 120/240	286215
54.	15 KVA	Line Material 120/240	286105
55.	15 KVA	Line Material 120/240	286074
56.	37.5 KVA	Line Material 120/240	285860
57.	15 KVA	Line Material 120/240	282370
58.	50 KVA	GE 120/240	K497535K72
59.	37.5 KVA	Megraw Edison 120/240	69B6751004
60.	37.5 KVA	Megraw Edison 120/240	H1298101
61.	15 KVA	Line Material 120/240	298980
62.	15 KVA	Line Material 120/240	286202
63.	25 KVA	GE 120/240	FS60070-66P
64.	15 KVA	Line Material 120/240	286133
65.	15 KVA	Line Material 120/240	286121
66.	75 KVA	Line Material 120/240	285792
67.	50 KVA	Line Material 120/240	288508
68.	50 KVA	Allis Chalmers 120/240	1809975
69.	50 KVA	Allis Chalmers 120/240	5369663
70.	50 KVA	Allis Chalmers 120/240	5369659
71.	25 KVA	Allis Chalmers 240/480	3500931
72.	37.5 KVA	Allis Chalmers 240/480	1812286
73.	10 KVA	Line Material 120/240	286300
74.	25 KVA	Line Material 120/240	288102
75.	9 KVA	GE 240	B978542
76.	37.5 KVA	Line Material 120/240	918945
77.	37.5 KVA	Line Material 120/240	918890
78.	37.5 KVA	Allis Chalmers 120/240	1812289
79.	10 KVA	GE 120/240	G296130-65Y
80.	37.5 KVA	Line Material 120/240	?
81.	75 KVA	Moloney 120/240	1752276-2
82.	75 KVA	Moloney 120/240	1752276-3
83.	75 KVA	Moloney 120/240	1752276-1
84.	25 KVA	Harrison 120/240	67104
85.	37.5 KVA	Allis Chalmers 120/240	1812279
86.	45 KVA	Kuhlman 208/120	3-4744
87.	37.5 KVA	Megraw Edison 120/240	H1298103
88.	5 KVA	Kuhlman 120/240	A24133
89.	150 KVA	Padmount Westinghouse 480/277	77D458183
90.	150 KVA	Padmount Vantran 480/277	77V4964
91.	75 KVA	Padmount GE 480/277	S-NM320394THPA
92.	500 KVA	Padmount GE 208/120	NL707216TELA
93.	75 KVA	Padmount RTE 208/120	756002710

PCB LABORATORY ANALYSIS RECORD

DATE: 14 Sep 81

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY: TRANSFORMER OILS

DATE RECEIVED: 16 Jul 81

SAMPLE FROM:

LAB CONTROL NUMBER: SEE OEHL NO BELOW

TEST FOR: POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY: GAS CHROMATOGRAPHY *(GC)*

OEHL NUMBER	BASE NUMBER	PPM
28485	47	ND<6
28486	48	ND<6
28487	49	ND<6
28488	50	ND<6
28489	51	ND<6
28490	52	TR<12
28491	53	ND<6
28492	54	ND<6
28493	55	ND<6
28494	56	ND<6
28495	57	ND<6
28496	58	ND<6
28497	59	ND<6
28498	60	ND<6
28499	61	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

140 TAC Hosp/SGP
Buckley Ang Base
Aurora CO 80011

P1 of 7PP

PCB LABORATORY ANALYSIS RECORD

DATE

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS (*PCBs*)

METHODOLOGY
GAS CHROMATOGRAPHY (*GC*)

OEHL NUMBER	BASE NUMBER	PPM
28500	62	ND<6
28501	63	396
28502	64	NO SAMPLE RECEIVED
28503	65	ND<6
28504	66	ND<6
28505	67	ND<6
28506	68	TR<12
28507	69	TR<12
28508	70	TR<12
28509	71	TR<12
28510	72	TR<12
28511	73	ND<6
28512	74	ND<6
28513	75	58
28514	76	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY (*Mailing Address*)

P2 of 7PP

OEHL FORM

PCB LABORATORY ANALYSIS RECORD

DATE

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY
GAS CHROMATOGRAPHY *(GC)*

OEHL NUMBER	BASE NUMBER	PPM
28515	77	ND<6
28516	78	ND<6
28517	79	ND<6
28518	81	ND<6
28519	82	ND<6
28520	83	ND<6
28521	84	TR<12
28522	85	ND<6
28523	86	ND<6
28524	87	ND<6
28525	88	ND<6
28526	89	ND<6
28527	90	ND<6
28528	91	ND<6
28529	92	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

P3 of 7PP

OEHL FORM 4

PCB LABORATORY ANALYSIS RECORD		DATE
TO:	FROM: USAF OEHL/SA Brooks AFB TX 78235	
SAMPLE IDENTITY: TRANSFORMER OILS		DATE RECEIVED
SAMPLE FROM		LAB CONTROL NUMBER
TEST FOR: POLYCHLORINATED BIPHENYLS *(PCBs)*		
METHODOLOGY: GAS CHROMATOGRAPHY *(GC)*		

OEHL NUMBER	BASE NUMBER	PPM
28530	93	ND<6
28531	1	ND<6
28532	2	NO SAMPLE RECEIVED
28533	3	17
28534	4	ND<6
28535	5	ND<6
28536	6	ND<6
28537	7	ND<6
28538	8	55
28539	9	ND<6
28540	10	ND<6
28541	11	ND<6
28542	12	ND<6
28543	13	ND<6
28544	14	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

P4 of 7PP

PCB LABORATORY ANALYSIS RECORD

DATE

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS (PCBs)

METHODOLOGY
GAS CHROMATOGRAPHY (GC)

OEHL NUMBER	BASE NUMBER	PPM
28545	15	ND<6
28546	16	ND<6
28547A	17A	ND<6
28547B	17B	ND<6
28548	18	ND<6
28549	19	NO SAMPLE RECEIVED
28550	20	ND<6
28551	21	ND<6
28552	22	ND<6
28553	23	ND<6
28554	24	TR<12
28555	25	NO SAMPLE RECEIVED
28556	26	TR<12
28557	27	ND<6
28558	28	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY (Mailing Address)

OEHL FORM

PCB LABORATORY ANALYSIS RECORD

DATE

TO:

FROM: USAF OEHL/SA
Brooks AFB TX 78235

SAMPLE IDENTITY
TRANSFORMER OILS

DATE RECEIVED

SAMPLE FROM

LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS (PCBs)

METHODOLOGY
GAS CHROMATOGRAPHY (GC)

OEHL NUMBER	BASE NUMBER	PPM
28559	29	ND<6
28560	30	ND<6
28561	31	ND<6
28562	32	ND<6
28563	33	ND<6
28564	34	ND<6
28565	35	ND<6
28566	36	TR<12
28567	37	12
28568	38	TR<12
28569	39	21
28570	40	15
28571	41	15
28572	42	ND<6
28573	43	ND<6

COMMENTS

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY (Mailing Address)

PCB LABORATORY ANALYSIS RECORD	DATE
TO: / FROM: USAF OEHL/SA Brooks AFB TX 78235	
SAMPLE IDENTITY: TRANSFORMER OILS	DATE RECEIVED
SAMPLE FROM	LAB CONTROL NUMBER

TEST FOR
POLYCHLORINATED BIPHENYLS *(PCBs)*

METHODOLOGY
GAS CHROMATOGRAPHY *(GC)*

OEHL NUMBER	BASE NUMBER	PPM
28574	44	ND<6
28575A	45A	25
28575B	45B	20
28576	46	17
28636	9293337	ND<6
28637	18742	ND<6
28638	11602	ND<6
28639	793-94	ND<6

COMMENTS

LEOPOLDO L. RODRIGUEZ, GS12
Trace Organics Analysis Function
Environmental Chemistry Branch

ADRIAN SANCHEZ, GS9, Technician
Trace Organics Analysis Function
Environmental Chemistry Branch

ND - None detected. Less than the detection limit.
Trace - Present but less than the quantitative limit.

REQUESTING AGENCY *(Mailing Address)*

APPENDIX H

REFERENCES

References

1. "Air Installation Compatible Use Zone," Buckley ANGB, Feb. 1976.
2. Histories of Buckley Field, Lowry AFB, and the 140th Fighter-Bomber Wing, obtained from Maxwell AFB, Alabama.
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14. The Merck Index, An Encyclopedia of Chemicals and Drugs, Merck and Company, Inc., Rahway, NJ, 1976.
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APPENDIX I

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX I

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practicies at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further action at sites based upon information gathered during the records search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with representatives from USAF Occupational Environmental Health Laboratory (OEHL), Air Force Engineering Services Center (AFESC), Engineering-Science (ES) and CH_2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for six months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, ES, and CH_2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site would be deleted from consideration for rating if neither of the above is the case.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the USAF's site rating model uses a scoring system to rank sites for priority attention; however, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the records search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant, and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned; for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and groundwater migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes received the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by five percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

Figure I.1 contains a flow chart of the rating methodology. Figure I.2 contains a sample rating form. Table I.1 contains guidelines used when applying the rating method and Table I.2 contains suggested waste characteristics scores for commonly used compounds.

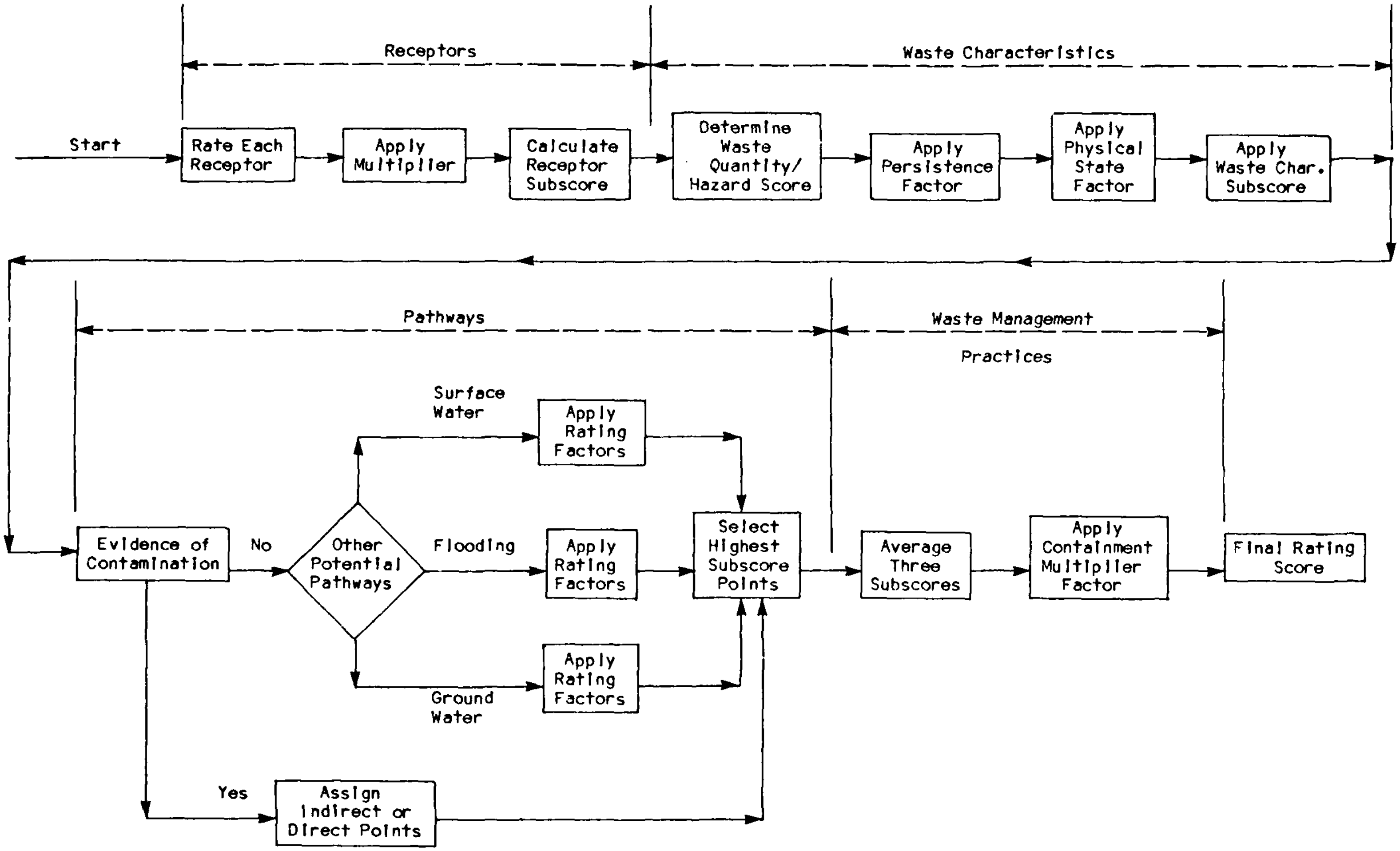

FIGURE I.1. HAZARDOUS ASSESSMENT RATING METHODOLOGY

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE ______________________________

LOCATION ______________________________

DATE OF OPERATION OR OCCURRENCE ______________________________

OWNER/OPERATOR ______________________________

COMMENTS/DESCRIPTION ______________________________

SITE RATED BY ______________________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

Figure I.2. Hazardous assessment rating form

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ x ______ = ☐

Figure I.2 (continued)

Table I.1. Hazardous Assessment Rating Methodology Guidelines.

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels: 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	6
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	3
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

Table I.1. (continued).

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

Table I.1. (continued).

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

Table I.1. (continued).

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION					
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8
B-2 POTENTIAL FOR FLOODING					
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1
B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION					
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

Table I.1. (continued).

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

Table I.2. Toxicity Rating (0-3).

	Recommended Rating Factors		
	Toxicity	Ignitability	Radioactivity
Aviation Gasoline (AVGAS)			
(Leaded fuel - 140 octane)	2	3	0
(Fuel Tank sludge, TEL)	-	-	-
Jet Fuels			
JB			
JP-1			
JP-4	1-2	3	0
JP-5			
JP-6			
(Fuel tank sludge)	2	2	0
Paints			
Enamels	1	2	0
Lacquers	1	3	0
Epoxy	1	2	0
Polyurethanes	1	2	0
Solvents			
Polychlorinated Biphenyls	1-2	0	0
Trichloroethylene	2	0	0
Trichlorethane (1,1,1- and 1,1,2-)	1-2	0	0
Methylene chloride	2	0	0
Methyl ethyl ketone	1-2	2	0
Metyl isobutyl ketone	2-3	1	0
Carbon tetrachloride	3	0	0
PD 680 (Stoddard Solvent)	1-2	1	0
Toluene	2	3	0
Xylene	2	3	0
Ethylene glycol	1	1	0
Other aliphatic hydrocarbons			

Table I.2. (continued).

	Recommended Rating Factors		
	Toxicity	Ignitability	Radioactivity
Sludges from Sewage Treatment Plants			
Cadmium (and salts)	3	0	0
Chromium (and salts)	3	0	0
Nickel (and salts)	3	0	0
Mercury (and salts)	3	0	0
Lead (and salts)	3	0	0
Phenol	3	0	0
Pesticides			
Herbicides			
2,4-D	1	0	0
2,4,5-T	1	0	0
Silvex	1	0	0
Insecticides			
Aldrin	3	0	0
Parathion	3	0	0
Malathion	1	0	0
Sevin	1	1	0
Diazinon	1	0	0
Arsenic compounds	3	0	0
DDT	1	0	0
Endrin	3	0	0
Dieldrin	3	0	0

APPENDIX J

WASTE SITE RATINGS

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Fire Training Area No. 2

LOCATION Buckley ANGB, near Control Tower

DATE OF OPERATION OR OCCURRENCE 1950(?) - 1972

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Fuels burning area

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) K
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 0.8 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			58	108

Subscore (100 X factor score subtotal/maximum score subtotal) 54

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	6	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	80
Pathways	54

Total 189 divided by 3 = 63 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

63 x 1.0 = $\boxed{63}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Oil Pit

LOCATION Buckley ANGB, near Building 711

DATE OF OPERATION OR OCCURRENCE 1950(?) - 1982

OWNER/OPERATOR Buckley ANGB

COMMENTS/DESCRIPTION

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	82	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 0.8 = 64

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

64 x 1.0 = 64

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	3	8	24	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			82	108

Subscore (100 X factor score subtotal/maximum score subtotal) 76

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	2	1	2	3

Subscore (100 x factor score/3) 67

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 76

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46
Waste Characteristics	64
Pathways	76

Total 186 divided by 3 = 62 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

62 x 1.0 = $\boxed{62}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Base Dump

LOCATION Buckley ANGB, along East Toll Gate Creek

DATE OF OPERATION OR OCCURRENCE 1942 - 1982

OWNER/OPERATOR Buckley ANGB

COMMENTS/DESCRIPTION

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	82	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) M
2. Confidence level (C = confirmed, S = suspected) K
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

80 x 1.0 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 0.75 = 60

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	3	8	24	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	82	108

Subscore (100 X factor score subtotal/maximum score subtotal) 76

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	2	1	2	3

Subscore (100 x factor score/3) 67

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
		Subtotals	24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 76

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	46
Waste Characteristics	60
Pathways	76

Total 182 divided by 3 = 61 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

61 x 1.0 = 61

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Fire Training Area No. 3

LOCATION Buckley ANGB, 5th and G Streets

DATE OF OPERATION OR OCCURRENCE 1972-1982

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Fuels burning area

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	86	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 48

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) L
2. Confidence level (C = confirmed, S = suspected) C
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

100 x 0.8 = 80

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

80 x 1.0 = 80

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			58	108

Subscore (100 X factor score subtotal/maximum score subtotal) 54

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			16	114

Subscore (100 x factor score subtotal/maximum score subtotal) 14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	48
Waste Characteristics	80
Pathways	54

Total 182 divided by 3 = 61 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

61 x 1.0 = $\boxed{61}$

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Fire Training Area No. 1

LOCATION Buckley ANGB, near reservoir

DATE OF OPERATION OR OCCURRENCE 1946(?) - 1950

OWNER/OPERATOR Buckley Fire Department

COMMENTS/DESCRIPTION Avgas burning area

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	3	8	24	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	74	108

Subscore (100 X factor score subtotal/maximum score subtotal) 69

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	3	8	24	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	2	8	16	24
Direct access to ground water	0	8	0	24
		Subtotals	40	114

Subscore (100 x factor score subtotal/maximum score subtotal) 35

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors 55
Waste Characteristics 40
Pathways 69

Total 164 divided by 3 = 55
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

55 x 1.0 = 55

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Storm Drainage System

LOCATION Buckley ANGB, near Building 801

DATE OF OPERATION OR OCCURRENCE 1942 - 1982

OWNER/OPERATOR Buckley ANGB

COMMENTS/DESCRIPTION

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	86	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 48

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 1.0 = 40

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 1.0 = 40

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	58	108

Subscore (100 X factor score subtotal/maximum score subtotal) 54

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	2	1	2	3

Subscore (100 x factor score/3) 67

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	16	114

Subscore (100 x factor score subtotal/maximum score subtotal) 14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	48
Waste Characteristics	40
Pathways	67

Total 155 divided by 3 = 52 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

52 x 1.0 = 52

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Sludge Drying Beds

LOCATION Buckley ANGB, Sewage Treatment Plant

DATE OF OPERATION OR OCCURRENCE 1942 - 1978

OWNER/OPERATOR Buckley Civil Engineering Department

COMMENTS/DESCRIPTION

SITE RATED BY TCT

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	0	10	0	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	95	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) H

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

40 x 0.75 = 30

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

40 x 0.75 = 30

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
		Subtotals	58	108

Subscore (100 X factor score subtotal/maximum score subtotal) 54

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
		Subtotals	16	114

Subscore (100 x factor score subtotal/maximum score subtotal) 14

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	53
Waste Characteristics	30
Pathways	54

Total 137 divided by 3 = 46 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

46 x 1.0 = 46

HAZARDOUS ASSESSMENT RATING FORM

NAME OF SITE Army Aircraft Burial Site

LOCATION Buckley ANGB, East of Control Tower

DATE OF OPERATION OR OCCURRENCE 1942 - 1945

OWNER/OPERATOR Army Air Force

COMMENTS/DESCRIPTION

SITE RATED BY TCF

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	2	10	20	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	2	9	18	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
		Subtotals	99	180

Receptors subscore (100 X factor score subtotal/maximum score subtotal) 55

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) S
2. Confidence level (C = confirmed, S = suspected) S
3. Hazard rating (H = high, M = medium, L = low) L

Factor Subscore A (from 20 to 100 based on factor score matrix) 20

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

20 x 1.0 = 20

C. Apply physical state multiplier

Subscore 3 X Physical State Multiplier = Waste Characteristics Subscore

20 x 0.5 = 10

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	3	6	18	18
Rainfall intensity	2	8	16	24
Subtotals			58	108

Subscore (100 X factor score subtotal/maximum score subtotal) 54

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
2. Flooding	0	1	0	3

Subscore (100 x factor score/3) 0

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water	2	8	16	24
Net precipitation	0	6	0	18
Soil permeability	0	8	0	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			24	114

Subscore (100 x factor score subtotal/maximum score subtotal) 21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 54

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	55
Waste Characteristics	10
Pathways	54

Total 119 divided by 3 = 40 Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

40 x 1.0 = $\boxed{40}$

APPENDIX K

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX K

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AFB: Air Force Base

AGE: Aerospace Ground Equipment

ANG: Air National Guard

ANGB: Air National Guard Base

ARTESIAN: Groundwater contained under hydrostatic pressure

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring

AVGAS: Aviation gasoline

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act

CES: Civil Engineering Squadron

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there are no implications of any specific limits because the degree of permissible contamination depends upon the intended end use or uses of the water

DET: Detachment

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including groundwater

DOD: Department of Defense

DOWN-GRADIENT: In the direction of decreasing hydraulic static head; the direction in which groundwater flows

DPDO: Defense Property Disposal Office, previously included R & M, Redistribution and Marketing

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors, and scavengers

EOD: Explosive Ordnance Disposal

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment

EPA: U.S. Environmental Protection Agency

EROSION: The wearing away of land surface by wind or water

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year

FLOW PATH: The direction or movement of groundwater and any contaminants that may be contained therein, as governed principally by the hydraulic gradient

FPT: Fire Protection Training

FTA: Fire Training Area

GROUNDWATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure

HARM: Hazardous Assessment Rating Methodology

HAZARDOUS WASTE: A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemidals due to heat generation in such a

manner that the likelihood of contamination of groundwater or escape of the substance into the environment is increased, any other reaction which might result in not meeting the Air, Human Health, and Environmental Standard

INFILTRATION: The flow of liquid through pores or small openings

IRP: Installation Restoration Program

JP-4: Jet fuel

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water

LINER: A continuous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate

RCRA: Resource Conservation and Recovery Act

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923)

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste

TAC: Tactical Air Command

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological

character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous

UP-GRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of groundwater

WATER TABLE: Surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere

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